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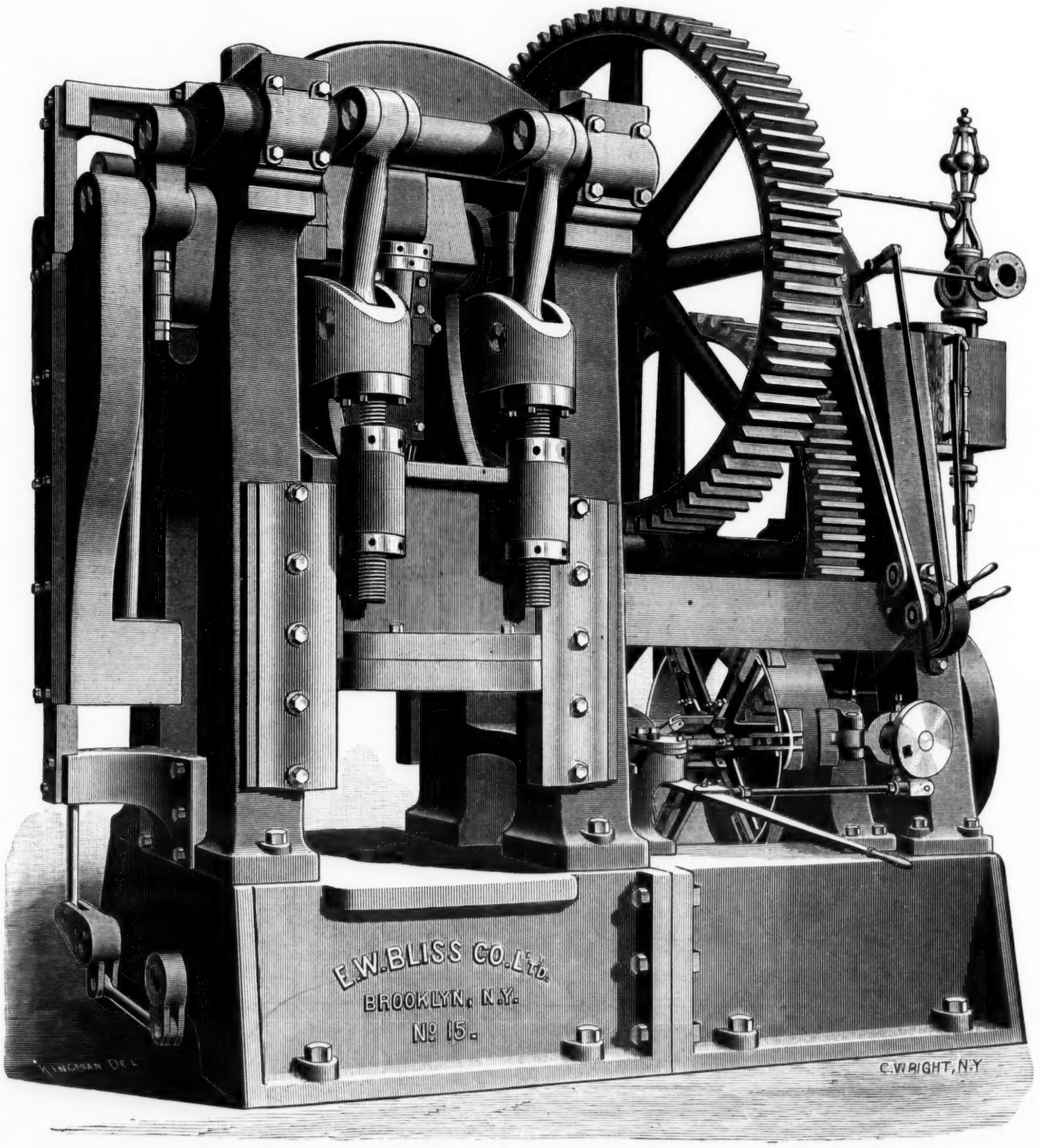
A Large Drawing Press.

It is being discovered by manufacturers of metal goods of various kinds, that many articles which it has been thought could only be produced by casting them, or by expensive processes of forging, can be made by the process of cold drawing, provided the proper machine is constructed, and the tools used with it are made with due regard to the behavior of the metal worked in the drawing press. Many comparatively thin and light articles, which have heretofore been cast, are now being drawn out of sheet metal, and the process is found to have so many advantages peculiar to itself, that the limits within which it is applied are constantly being extended.

The most recent example of this is afforded by the machine which is the subject of the present illustration, designed and built by the E. W. Bliss Company, Brooklyn, N. Y., for Kilbourne & Jacobs, of Columbus, Ohio, and to be used by them in drawing the common and familiar kitchen sink out of sheet steel, instead of casting them, as has been the practice up to this time.

The machine is remarkable in respect to the size of blank it will work; its great power and strength; in having an engine directly attached for driving, and in many of its features of construction, which are ingenious, and, we think, very creditable to its builders.

On this page we give a general view of the machine, while on pages 2 and 3 are some engravings showing some of the details of construction and method of operation; Fig. 1 being a side view; Fig. 2 a front view from the left of the machine, Fig. 3 a sectional plan; and Fig. 4 a side view from the right of the machine.



A LARGE DRAWING PRESS.

The machine consists essentially of a heavy base in two parts, upon one of which is the upright engine for driving, and the clutch mechanism, while from the other portion rise the massive uprights upon which are the guides for the blank holder, and which support the crank shaft and other mechanism seen at the top of the machine. The uprights are connected at the top by a heavy beam, which crosses from one to the other above the crank-shaft, and they are not subjected to tensile stress during the working of the machine, this stress being borne by the four bolts *b*, *b*, *b*, *b*, Fig. 3, which are 5 inches diameter, and pass through the uprights from the base of the machine to the top, nuts being fitted at top and bottom. The engraving shows the machine with the die removed, but it will be understood that this is secured to the base of the machine between the uprights, and may be of any desired form for the work to be done, and blanks up to 60 inches by 38 inches can be worked.

At the four corners of the uprights are the guides for the blank holder *B* (Figs. 2 and 3), these guides being formed in part by the plates *c*, *c*, *c*, *c*, which are bolted to the uprights. To the inner sides of the blank holder are secured by heavy bolts the two guides *g*, *g*, upon which the punch slide works.

This latter slide derives its motion from the crank-shaft *C* (Fig. 1) which, driven at a uniform speed by means of the large gear *G*, imparts to this slide a motion analogous to that of the piston of an engine, while, for reasons and by means to be hereafter explained, the blank holder has a much more irregular motion, the diagram, Fig. 5, showing clearly the relative motion of the two slides. The vertical distances on the diagram represent inches of travel of the slides, while the horizontal distances represent in degrees the angular motion of the crank-shaft *C*, the curved lines showing the relative positions of the two slides during a revolution of the shaft, or complete stroke of the machine.

At the left of the machine, attached to the crank-shaft, is the crank *A* (Fig. 2,) which, by means of the connection *D*, gives vertical motion to the sliding piece *E*, which works upon the single guide *F*. At the top of the sliding piece *E*, and at either side, are connected the short links *H*, by which motion is imparted to the cranks *I*, these in turn actuating the two auxiliary crank-shafts *J*, *J*, which pass along at either side of the main shaft *C*, and by means of the cranks *K*, *K*, and their connections, give motion to the blank holder slide.

By a little consideration it will be seen how these various connections operate to make the "dwell" of the blank holder shown by the diagram, Fig. 5, at the time the sliding piece *E* is at and near the upper limit of its motion, and while the slide carrying the punch is near the lower limit of its motion, which is when the actual drawing of the blank is being done. A study of the diagrams, Fig. 6, will help to make this plain, the one at the left showing the positions of the various parts when the sliding piece *E* is at its lowest point, and the blank holder raised to its extreme height, while the diagram at the left shows the various positions when the dwell of the blank holder is just beginning, the small movement of the sliding piece *E* during this period acting simply to swing the connections *H*, *H*, upon their centers, as shown by the dotted lines, but producing no perceptible movement of the blank holder, while the cranks *K*, *K*, and their connections, being in the same straight line, which is the line of thrust, the moving parts are relieved of all strain, thus avoiding undue wear, and making the full power of the machine available at this time, just when it is needed for the punch.

One object in making the piece *E* so heavy is that it may act as a counterbalance for the other moving parts.

In operation, the blank, which has previ-

ously been punched or trimmed to the desired size and shape, is placed over the die, and the blank holder then first descends in advance of the punch until it rests upon the blank, and exerts a heavy pressure all around its outer edge. The punch then descends and forces the middle portion of the blank into the die, drawing the metal out from between the face of the die and blank holder, which by its pressure prevents any kinking or buckling of the sheet. It will be seen, of course, that it is important to secure even pressure all about the blank, and this is provided for by making the blank holder in two parts, and putting in the four screws *a*, *a*, *a*, *a*, one of which being placed at each corner of the blank holder, and provided with suitable nuts, the pressure can be made uniform all over the face of the die. These screws serve also for the vertical adjustment of blank holder to suit different dies, the range of adjustment provided for being 8 inches. The punch can also be adjusted vertically by turning the shaft carrying the pinion *d* (Fig. 2), which engages with the bevel gear shown, this bevel gear being at the bottom of a large screw which affects the movement by means of a slide; the four bolts shown above the pinion, and on either side of the shaft, binding all tightly together when the proper adjustment has been made, so that no alteration can take place without first loosening them. The extent of this movement is 6 inches. The long connecting rod at the left of the machine, and extending from near the top to the bottom, gives motion to the device within the base, by which the blank is forced up out of the die when released by the blank holder.

The main crank-shaft *C* is 11 inches diameter, the gear which is keyed to it at the right being 7 feet 7 inches diameter, 12 inches face, and 4 inches pitch. It is driven by a pinion on the intermediate shaft, the large intermediate gear being driven by a pinion, which is not keyed directly to the engine crank-shaft, but to a sleeve which forms a portion of a Hill friction clutch, by which the motion of the press is controlled, a small movement of the lever starting or stopping the press promptly and smoothly, the clutch being so arranged that the movement of the lever which releases it applies a brake, which promptly arrests the motion, and thus the press can be handled with the greatest facility. The clutch and brake mechanism is clearly shown in Figs. 2 and 3.

The engine needs no special mention, except to say that it is of the simple construction best adapted to such a purpose, has a plain slide valve with throttling governor, and has the crank-pin for actuating the valve fixed to a disk, which is at the end of a return crank attached to the main wrist-pin. This disk is so mounted upon the return crank, that, when the engine is turned in either direction by hand, the disk so adjusts itself by turning upon its center, that the valve is set for running in the direction in which the engine has been turned, without any further attention being required.

The cylinder of the engine is 12x14 inches, and it is designed to run 250 revolutions, which gives the machine a speed of 5 strokes per minute, the gearing being proportioned fifty to one.

The press stands about fourteen feet high, and weighs about 60 tons.

It is, so far as we know, the largest and heaviest drawing press ever built—certainly in this country at all events, and it is expected—we believe with good reason—to achieve some noteworthy triumphs in the line of sheet metal drawing.

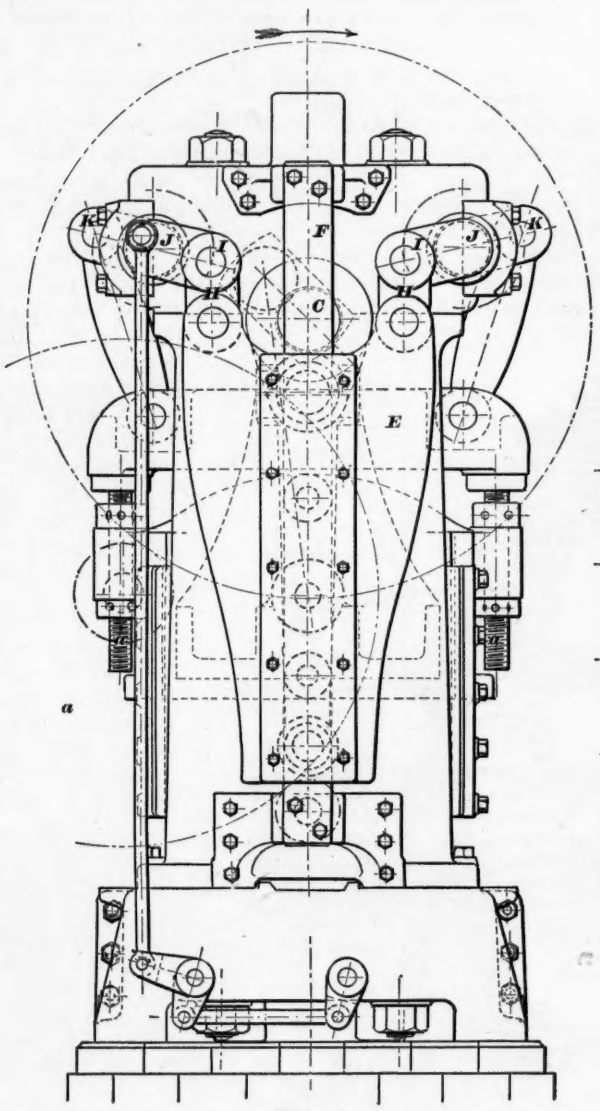


Fig. 1.

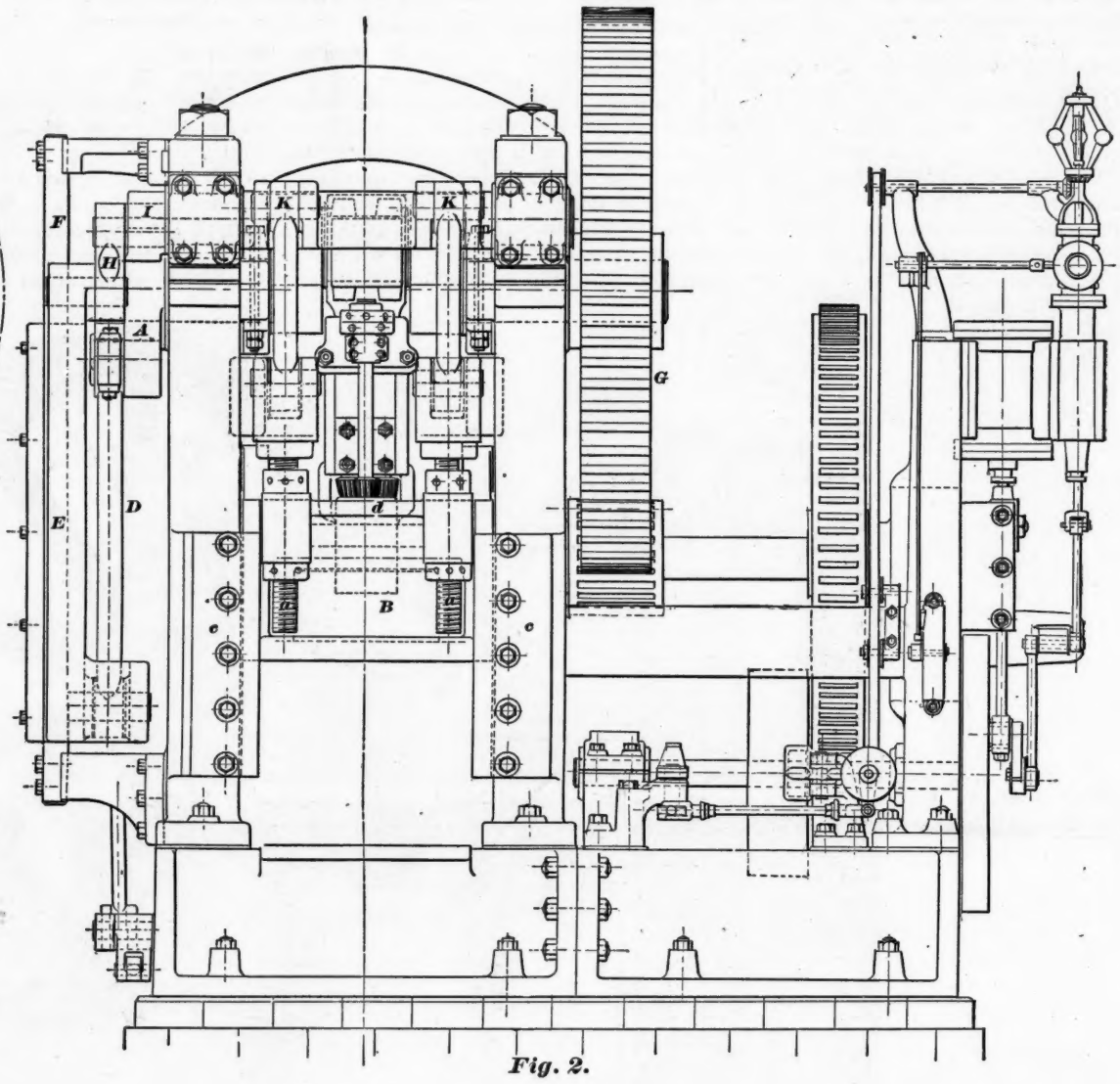


Fig. 2.

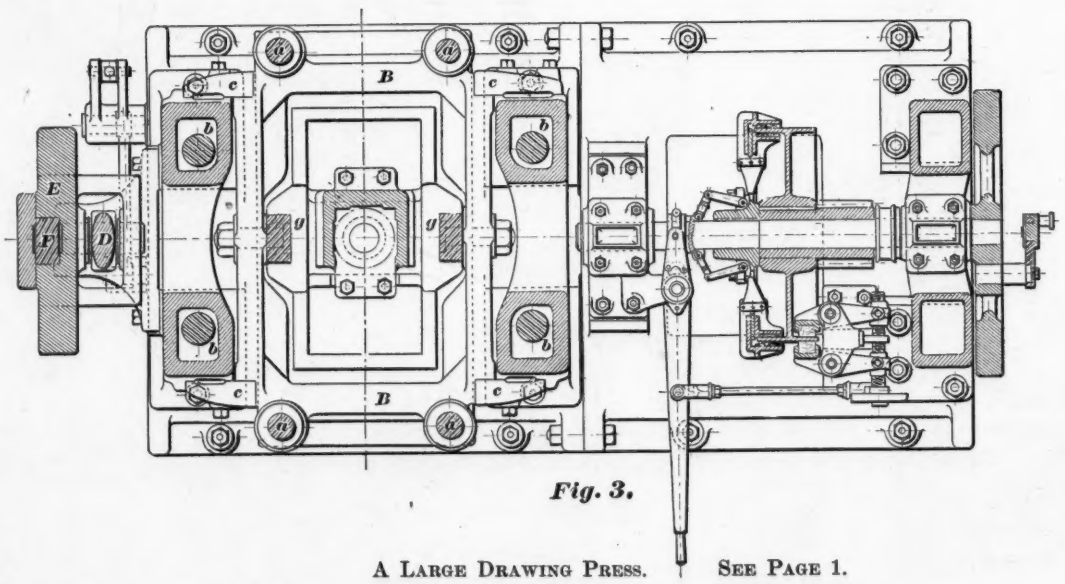


Fig. 3.

A curious railroad accident recently happened on the isthmus of Panama. As an express train was passing through a dense forest a large tree was struck by lightning and fell on the cars. Fortunately the train cleared the tree without more serious damage than some little shaking up of the passengers. A few minutes later a tree that had fallen across the track was encountered, but it was luckily seen in time to avoid coming in contact with it.

The number of passengers carried on the railways of the United States during the year was 472,171,343; the aggregate number of miles traveled was 11,553,820,445. This shows an average of 24.47 miles per passenger. The number of tons of freight carried was 539,639,583. The aggregate number of ton-miles was 68,727,223,146.

History of Attempts to Determine the Relative Value of Lubricants by Mechanical Tests.

AN ADDRESS BY PROFESSOR JAMES E. DENTON AT THE INDIANAPOLIS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The measurement of frictional resistance, or friction of rubbing surfaces, is a field in which experimenters have labored from as early a date as 1700.

For about a century subsequent to this date investigation was confined to the friction between solid bodies; and therefore the actions of unguents or lubricants between the rubbing surfaces appear not to have been studied until 1800. The variety of practical lubricants at this date was small. Lard, olive oil, and black lead were used almost universally. Experimenters appear to have sought the average value of the coefficient of friction, with all or any of these lubricants, rather than the determination of the difference between their respective abilities as friction-reducing elements.

The fact that a fluid or mobile oil was more difficult to be retained between two rubbing surfaces than was a thick or viscous lubricant, was, however, a distinction always recognized. Rennie, in 1829, experimenting on the friction of axles with 1,000 lbs. load, noticed that the coefficient of friction was less than for lighter loads. Hence he concludes that the less the pressure, the more fluid should be the unguent. Thus we have the idea of durability and friction-reducing power combined to serve as a basis of distinction between the practical value of even the few lubricants of this early age.

Genl. Morin, experimenting in 1833 with the deliberate intention of improving upon the work of all previous investigators, and undoubtedly broadly informed regarding any practical demand for distinctions of value between lubricants, apparently does not attempt to draw from his mechanical tests

A Large Drawing Press. See Page 1.

any conclusions regarding the value of one unguent with reference to another. Morin's measurement of friction of lubricated journals did not extend to light pressures. They apply only to the conditions of general shafting and engine work. He often refers to the circumstances which bring about the expulsion of lubricants from between rubbing surfaces. He also clearly understood that there was a frictional resistance, due solely to the viscosity* of the oil, and that, therefore, for very light pressures, the laws which he enunciated did not prevail. There can be little doubt that the effect of elevation of temperature in reducing the viscosity, and thereby the resistance due to friction, was well understood in Morin's time. Also the increase of the coefficient of friction at very slow speeds is a fact which is so clearly shown by a moving surface which gradually stops, that it could not escape the notice of any one using any sort of dynamometer to measure friction. In enunciating his celebrated laws of friction, which maintain that the coefficient of friction†, is independent of speed, pressure and surface; it is not to be supposed that he failed to learn that they were not exact for light pressures, but rather that he did not see any practical demand for measurements under conditions different from those to which he applied his dynamometers; namely, to ordinary shaft journals *without special preparation of the rubbing surfaces; and without resorting to artificial methods of supplying the oil.* In confining his experiments to practical conditions, such as still apply to the majority of machinery in use everywhere, and ignoring irregularities of data, evidently within the unavoidable variations of practical conditions of service, Morin, through the declaration of his simple laws, supplied the engineering profession with a greater proportion of all the knowledge that is useful regarding the friction of general machinery, than has any other one experimenter. Later experimenters have with few exceptions devoted themselves exclusively to the measurement of resistance practically due to viscosity alone. They have eliminated the resistance to which Morin confined his measurements, namely, the friction due to such contact of the rubbing surfaces as prevail with a very thin film of lubricant between comparatively rough surfaces. Thus Hirn, in 1854, balanced a brass on the top of a large journal, so that the friction could be measured by the load necessary to maintain equilibrium. The lower segment of the journal was *immersed* in a bath of oil to be tested. This is the first artificial condition tending to eliminate the friction due to metallic contact. A second such condition was the nursing of the journal by long preliminary running to a degree of smoothness inconsistent with the ordinary roughness of the bearings. The pressures were quite light, and the results discover that a considerable variation of friction is caused by a variable range of temperature, because the friction was mainly that due to viscosity, and the latter property decreased with increase of temperature. Also the coefficient of friction was found to be not independent of the pressure, or area of surfaces; another evidence of the fact that the resistance under measurement was not the friction of metallic contact, but that due to viscosity alone. Hirn's apparatus was the first to control the temperature by the circulation of water through cored passages in the brass; and he was the first experimenter who determined friction over the wide range of temperature from 0 to 500 degrees Fahr. A long list of experimenters have worked in the same field since his time. Prominent among them are, Napier, Conti, Thurston, Woodbury, Waite, Wilson, Pullin, Kimball, Wellington, Tower, Reynolds, Goodman, and workers at the laboratories of the Eastern Railway of France, at various other English and American railways, and at the U. S. Navy Yard at Brooklyn. All have contributed some original matter to the subject, either in their apparatus or by investigating special conditions of lubrication.

In every case, however, the supply of oil has been unrestricted, or the rubbing surfaces have been artificially smooth, or both these conditions have simultaneously obtained. The results with one exception have consisted solely of the measurement of the coefficient of friction. They have generally been useful in exhibiting some interesting variation of friction due to change of pressure, speed, or surface of bearings, but are consistent only with the view that the resistance measured was largely that due to viscosity, and not the friction of metallic contact. As a natural result of these investigations, measurements of the coefficient of friction have come to be regarded as essential to a knowledge of the character of lubricants, and apparatus for this measurement, or "oil-testing machines," are now to be found in operation, in the hands of experts employed by various large consumers of lubricants. The possibilities of using such apparatus for determinations of differences of lubricating value of oils and greases for external bearings is the special subject to which I invite attention.

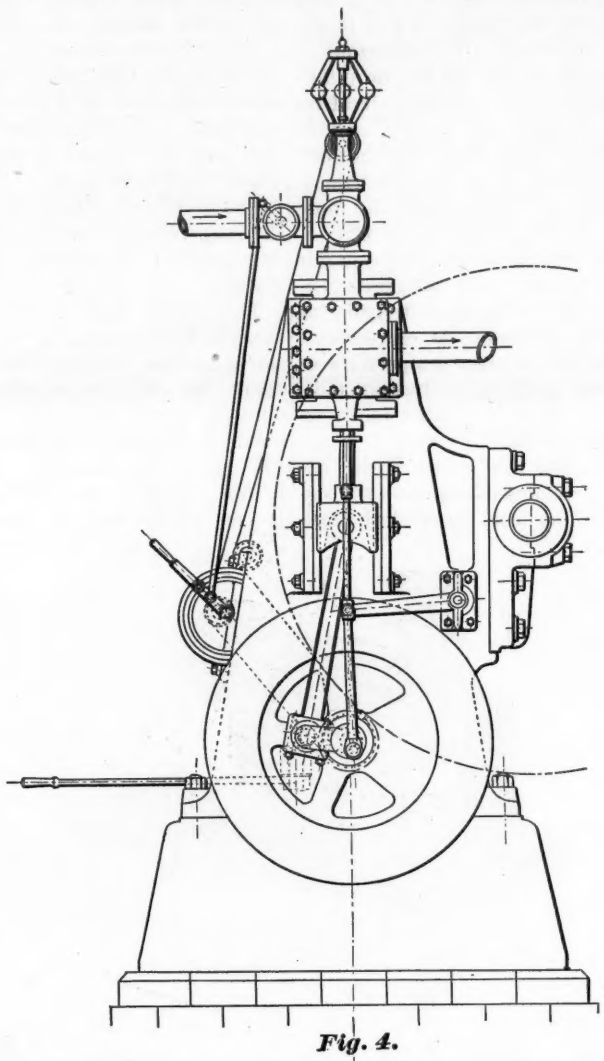


Fig. 4.

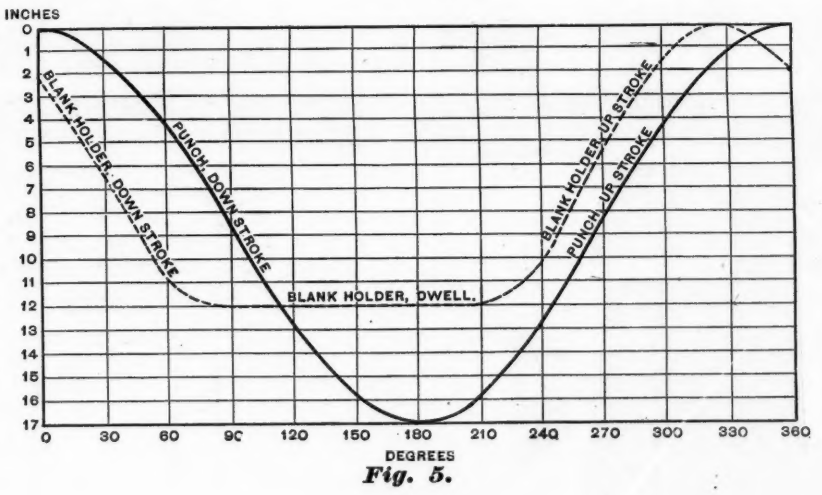


Fig. 5.

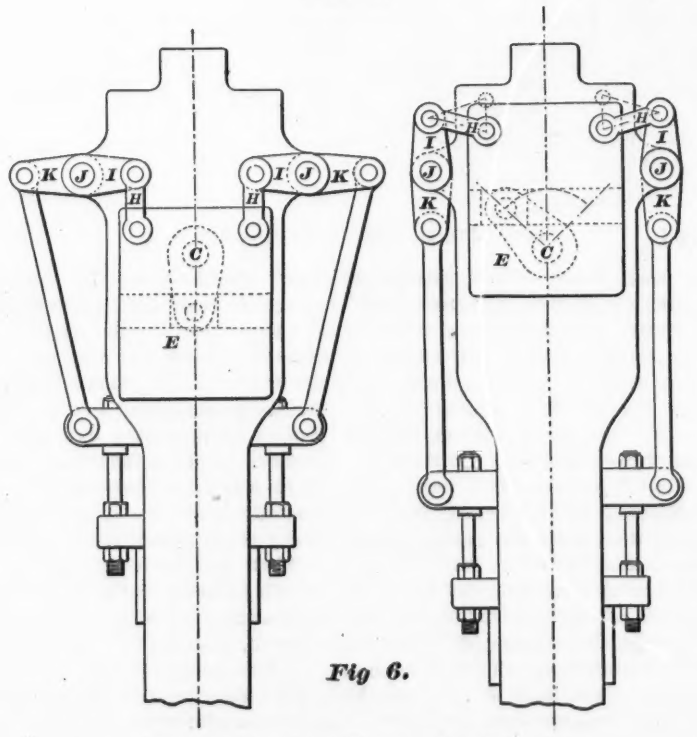


Fig 6.

A Large Drawing Press.—See Page 1.

The advent of petroleum products as lubricants has afforded an almost infinite variety of combinations and qualities of lubricants. Instead of choosing his lubricant from among the few simple materials of Morin's time, the consumer must now decide among a great variety of samples, every possible mixture being represented to him as possessing some peculiarity of lubricating value. Moreover, he is asked to believe, on the one hand, that an oil nearly as thin as water will lubricate nothing but a cotton spindle, and, on the other, that sand is beneficial to a railroad box. He is told that only a particular expensive cylinder oil can make his engine run safely, and, on the other hand, that best results will follow from using no oil at all. Various measurements of an oil can be made by the chemist. Such elements as specific gravity, evaporative qualities, tendency to spontaneous combustion, viscosity, proportion of animal ingredients, combustion residue, etc., can be readily and definitely determined. But these, while serving to fix the identity of the lubricant for purposes of duplication, for example, are all of no weight in determining the ability to lubricate, compared to the evidence of some mechanical test, to which, it is claimed, the lubricant has been subjected by practical service, or which, it is supposed, may be available in an oil-testing machine. To fix the ideas regarding the capabilities of oil-testing machines, consider the following facts:

Case 1.—The principal expense of power in a cotton mill is the friction of the machinery. The pressure of all the bearings is comparatively light; there is, therefore, no sensible wear of the metallic parts of the bearings. The shafting is provided with oil cups, which reduces the waste of oil to a minimum, and the drippings from bearings are filtered for repeated use. The spindles which consume the bulk of the power run in cups or baths of oil.

The driving resistance is, therefore, purely that due to the viscosity of the oil. A number of oils are offered for lubrication of the spindles. They are all equally satisfactory as regards volatibility, fluidity, flashing point, etc. What will a mechanical test on an oil-testing machine tell us regarding the relative value of the oils? Answer: It can show that there are mixtures of animal and mineral oils, which will offer but half the frictional resistance of lard or sperm oils, which formerly were exclusively used. Any form of oil tester, such as the "Woodbury," "Thurston," "Ashcroft," "Pullin," or "Tower," can be used to show this; they have only to be fitted with bearings of maximum smoothness. Then, by feeding the oil to be tested, so as to provide a surplus supply, the differences of resistance due purely to viscosity will be measurable, and the results will apply to the case of the cotton spindles. Other things equal, the oil of the least viscosity gives the least resistance, and in this case all other things are equal for a large number of oils.

As between sperm or lard and a mineral oil, however, there would be an element which the testing machine could not show; that is, the tendency of the animal oil to gum by exposure to the air and dust. The necessary time of exposure would be so great, that it would be impractical to show this phenomenon on the testing machine. The latter's sole function would, therefore, be the measurement of the relative viscosity, which the experiments of Waite* show could be as well done by noting the time of flow out of a pipette.

Case 2.—Let us suppose that a rolling-mill

* [Art. 257] Morin's Mechanics by Bennet.

† Morin distinctly states that the term friction is used by him to mean resistance between lubricated surfaces, which is not created by the viscosity of the oil.

* Trans. N. E. Cotton Manufacturing Association.

manager, having heard that the oil-testing machines have saved considerable money to cotton-mills, by showing them better oils than lard or sperm, concludes to resort to this method of investigation to decide between such lubricants as are offered for general service on their machinery. The latter is of the heaviest description, viz., roll trains, whose bearings, when rolling heavy masses of iron, are subjected to the most violent strains, and all sort of dust has access to them. The usual lubricants are the most viscous kinds of oils and greases. These are tried upon the oil-testing machines in comparison with lard oil, and are found to have several times greater frictional resistance than the lard oil at ordinary temperatures. The testing machine is found to behave very irregularly when the oil is applied in the irregular manner common in the mills. The operator can see no regularity in his results, unless the supply of oil to the testing machine journal is made so superabundant that no momentary deficiency can exist. He also finds that, even with a surplus feed of oil, he can have no uniformity of results, so long as the brasses of his testing machine are as rough as are the bearings on the machinery in the mill. No attempt is made, therefore, to copy the condition of roughness of the bearings of practical service.

Uniformity of results strikes the operator as essential above all else. The sole elements of equality between the conditions on the testing machine finally become the pressure per square inch, and the rubbing speed. The pressure may reach 500 pounds per square inch. The test is made at this pressure, but the rate of feeding the oil is artificial in its surplus character, and hence, there is no possibility of its being momentarily deficient. Also, the surfaces have become polished by long running, accompanied by a constant lateral movement lengthwise of the journal, either automatic or maintained by hand. The surfaces do not need to be free of cinder cracks or of scratches, but they are prevented from wearing to fit each other in rings or grooves by the lateral motion. The result of the test is, that the friction of the greases and the thick lubricants, such as heavy petroleum cylinder oil at ordinary temperatures, is several times greater than lard or sperm oil. The operator reports this fact to the mill manager, and the latter may attempt to apply it in his practice, by changing to lard, which we will assume can be had as cheap as the thicker lubricants. Immediately the fact will exhibit itself that it is impossible to maintain satisfactory lubrication about the mill machinery, without expending several times more* lard oil than has sufficed with the more viscous lubricants.

It is impossible for any one to appreciate through the medium of the mill machinery that there is less friction with the lard than there has been with the viscous lubricants, because the friction of the bearings is so trifling a proportion of the whole expense of power, which is mainly absorbed by the resistances of the iron squeezed in rolls. If the lard is supplied in sufficient abundance to insure plenty of it being avaliable at every spot of the bearing there will be no overheating or cutting. But the whole system of feeding the bearings, or the amount of attention necessary to supply the oil will be so much more troublesome to the workmen, that the lard oil would not be fed with sufficient regularity to prevent occasional deficiency of supply, and the probability is that overheating or cutting would occur with it, which might never have occurred with the more viscous lubricant.

The fact will be learned in this case that the sole element of value in a lubricant in rolling-mill work is the slowness with which it will allow itself to be squeezed out from between the bearing surfaces. And this quality belongs in the highest degree to the most viscous lubricants. The reduction of friction, so far as it depends on the difference of resistance due to viscosity, is of no consequence in this case, and the metallic wear of the bearings is practically absorbed in the roughness of the surroundings, although, so far as it is concerned, the more viscous lubricant affords the least wear.

What has the testing machine told us in this case, that is of value? Only that greater viscosity makes more friction, which again we could determine by running the oils through any sort of orifice at some temperature at which they were fluid, or by observation direct, but which is not a sensible factor in rolling-mill lubrication.

Case 3.—Consider now heavy marine engines. A large number of engineers will say that greases are the most economical lubricants for such service. Such greases are applied in the best manner by "grease cups" having a piston forcing the grease upon the bearing by spring pressure. Or else a copper rod rests upon the bearing and penetrates the grease. If the shaft or bearing becomes too warm by increase of friction, the pin melts some of the grease, and the latter supplies itself to the journal, which then, generally, is sufficiently well lubricated.

It is held that, while the greases cannot lubricate a bearing which is roughened or sore, as well as oil plentifully fed by a wick or some form of constant feed oil cup, yet, on the average, the expense of lubrication by grease is far less than with the oil, because the grease will feed itself at a slower rate than is possible with the oil.

Let us turn to our testing machine and test upon it the grease fed with the spring cup or the copper rod, and compare the results with lard oil fed with wicks at about the same degree of plentifulness common in marine works. Again we meet the irregularity of results referred to in Case 2, so long as the bearings are as rough as we would find them on the majority of marine engines, and we eliminate this element by nursing the journal to unusual smoothness. There is, then, no definite difference in the friction when there is plenty of each lubricant on the journal, but occasionally there is a deficiency of grease supplied, despite the operator's efforts at feeding, and the friction is then temporarily greater than with the oil. On the whole, the grease gives more friction than the oil, unless the temperature of the bearings is allowed to be upwards of 25 degrees higher than with the oil.

The marine engineer will agree that the bearings always do feel a little warmer with the grease than with the oil, but he cannot see that the extra heat interferes in any way with the best performance of the engine as obtained with oil. There is no greater metallic wear of the bearings. But the saving in the amount of lubricant consumed is so large that it outweighs every other qualification. He will carry for emergency some fluid oil, because occasionally some bearing will overheat from some cause undefined, and the temperature will rise to an excessive amount in so short a time that the grease cannot supply itself quickly enough to prevent a dangerous amount of cutting. He then falls back upon the fluid oil for a few days, because its supply can be perfectly controlled so as to insure no deficiency at any spot of the journal.

What has the testing machine, with its smooth journals, told us that is of value to the marine engineer?

Again, only that the grease has more viscosity resistance than the oil.

[We shall publish further from this address in a later issue.]

In describing the iron planer, in our issue of Oct. 9, page 1 in the tenth line, there is a misprint; the word "special" should be "spiral."

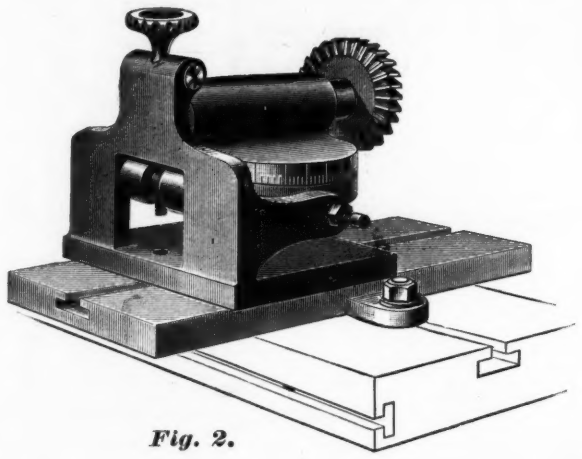


Fig. 2.

Fig 1. The "Challenge" Grinding Machine.

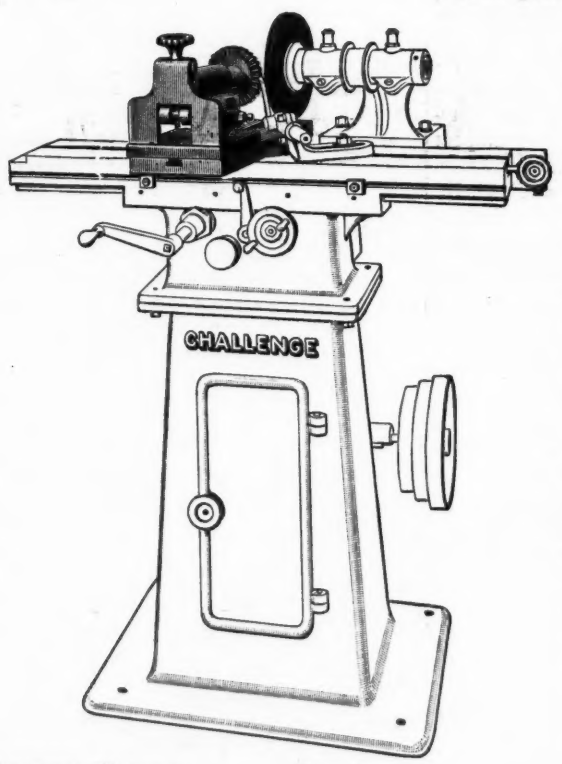


Fig. 3.

The "Challenge" Grinding Machine.

We give on this page and on page 5 some illustrations of a machine designed to finish by grinding, upon dead centers or otherwise, cylindrical or tapering work up to 20 inches in length, and 10 inches swing, which will also do internal grinding, and, by the use of an attachment which is shown, grind cutters of any of the ordinarily used forms.

At Fig. 1 we give a general view, which shows that the machine is mounted upon a column, within which is the feed and traversing mechanism, the feed being driven by a belt from the countershaft, which runs upon cone pulleys having three steps for changes in the rate of feed. The platen is reversed by movable dogs, and can be moved by the crank-handle shown, while the emery wheel is moved to or from the work by means of the small hand-wheel shown in front and at the right. The wheel base slide is on a bracket which is cast to the back of the bed of the machine, the wheel base moving upon broad slides, and being so arranged that the wheel can be turned at an angle in either direction for facing, though the cross-slide does not swivel, but always remains at right angles to the bed.

The upper part of the platen swivels, however, to allow of tapers being ground up to 2½ inches to the foot. The emery wheels are not placed directly upon the grinding spindle, but this spindle is bored with a taper hole for the reception of arbors, upon which wheels of any desired size or character within the limits of the machine may be used. The drum overhead, from which the work is driven, is provided with a cone pulley, by which three variations of speed for the work are secured. All sliding surfaces are carefully fitted and gibbed in such a way as to secure good working, and provision is made for taking up wear in all journals.

In Fig. 2 is seen the attachment for grinding cutters. It is so arranged that the arbor upon which the cutters are placed can be made to lie either in a line parallel with or at right angles to the platen, the cuts showing it in the latter position. The arbor, which has the usual collars and a nut at each end, passes through an upward extension of the graduated plate, this plate being arranged to swivel and clamp at any desired angle. The corresponding plate below is supported by set-screws at each side, upon which it swivels in a vertical plane, being moved by means of the screw shown, which passes down and is tapped into a rock-shaft, so that by turning this screw one way or the other any desired inclination of the arbor can be secured.

These two swiveling motions combined make it possible to properly grind face or square cutters, or cutters of any angle, varying the clearance on the cutting edges at pleasure.

Fig. 3 shows the attachment as in use on the machine, grinding a face cutter; Fig. 4 the method of grinding the end face of a cutter (such as a spiral-mill) true, the wheel being set at an angle for the purpose; Fig. 5 the method of grinding a taper reamer, and Fig. 6 internal grinding, which, of course, may be done straight or taper, the platen swiveling for the latter up to 2½ inches to the foot.

Face mills up to 8 inches diameter can be ground on the cutter-grinding attachment. The machine weighs about 800 pounds, and is built by the Appleton Mfg. Co., Thirtieth and Thompson streets, Philadelphia.

It is said that one of the results of the use of smokeless powder in war will be the abolition of the gaudy uniforms in which European soldiers are bedecked. Plain hues must be used, lest a too conspicuous mark be presented to the enemy.

* Vide comparison of lard oil with more viscous oils on large rolling-mill engine. Paper CCLXXXV. Vol. IX, Trans. Am. Soc. Mech. Engrs.

Final Work of the Local Committee, N. A. S. E.

The committee, consisting of members of the associations of New York and vicinity, and of the business men who contributed towards the expenses of holding the late convention of the N. A. S. E. in New York, held their final meeting on Sunday, Oct. 12, when the committee appointed to examine into the receipts and expenditures rendered its report. This report mechanical papers were requested by the committee to publish, to the end that members throughout the country may understand what was done in the matter of finances. It was as follows:

REPORT OF COMMITTEE.

NEW YORK, Oct. 5, 1890.

To the Local Committee, N. A. S. E.

We, the committee appointed to examine the vouchers and accounts for the entertainment of the delegates to the convention, find that the committee has received $5,505.40, and has paid out $5,448.88, leaving a balance in the hands of the chairman of the committee of $56.52, which amount we deem best to leave with him until certain disputed claims are settled.

(Signed)

H. M. SWETLAND,
F. F. HEMENWAY,
RANDOLPH BRANDT,
JOHN T. MAHER,
J. THORNTON,
WM. H. CRONLEY,
of the Committee.

Moods—Extortion—The Gift Association.

BY JARNO.

Wanderon hands me a paper saying, "Perhaps this will interest you."

I read: "Our long acquaintance may have exhausted all surprises, and the story been told to your mood. Even though this be the reason for your silence, I do not criticise; whatever are your motives, I trust you implicitly," etc.

I have never felt that I quite understood Wanderon. In all that he says I take a lively interest, yet, though we have met times enough to bring most men together on terms of easy familiarity, I have never asked him a question. Being typewritten, one can hardly attach any personality to the paper. I did not understand, and I did not ask whether it is an extract from a real letter, or merely a sketch to illustrate some principle of human nature. It gave me something to think of; the idea of having an acquaintance that is continually giving us surprises is worth entertaining, especially if they are agreeable, if we can conveniently have such acquaintances. The next time I met Gascon I was reminded that with him surprises are still on. At first I took him to be in a pleasant story-telling mood, but I soon perceived that his stories had a critical drift, which is not always quite pleasant.

Following are some of his stories, which, I hope, will be profitable, if not pleasant:

"I have an acquaintance named Daer, who makes sheet metal ornaments. He stepped from his shop into his office, and there stood a policeman in full uniform, and with him a man in citizen's dress, who, as it turned out, was also a policeman. The one in uniform had his club in hand, and was supposed to be on duty, but had left his beat to come into Daer's office. For a moment Daer had some anxiety, or rather curiosity, to know just what policemen had to do either in his office or with him. He soon learned that they were soliciting subscribers for a book bearing upon the history of the police department. They had come in merely to suggest what a good thing it would be for him to subscribe for the book, as in it his business would be advertised, and thereby increased, besides, the history of the police is valuable. He subscribed, though he well knew that the book, either with or without the advertisement, would never benefit him any more than a carpet tack down the back of his neck. Now, the underlying fact of the whole transaction is that it was not less than a polite extortion, or a white blackmail. In plain English, he took the book, because he did not wish to be on bad terms with the police. It is obvious that the policeman had no right or business to leave his beat while on duty, and that Daer could have reported him, but, on the whole, it was cheaper to take the book than otherwise. Once a year, Daer pays two dollars for a ticket to the policemen's ball, which he never attends.

"Then came the Grabshek highness, who asked for money to help the Grabsheks build a temple to their Empyrean. Daer is struggling in his business, and has so many ways for his money to go, that really he ought not to give anything. The highness patted him on the shoulder, saying, 'O but you *must* give something.' He looked over the list of those that had already subscribed, and then subscribed himself, though he has never been, and probably never will be inside a Grabshek temple. So many of his customers are Grabsheks that he does not dare to refuse, for fear that the highness will have him put on the black list, and injure him in his business. A white or a polite blackmail again.

"These are but a few of the schemes to which he subscribes in the course of a year. The letter carriers have schemes and a yearly ball, which he pays for, and never sees. The carriers become very suave for several weeks before Christmas. They go into ecstasy at the sight of new designs in ornaments made by Daer, and finally settle upon some two or three as being more beautiful than all the rest. In order to induce the carriers to continue being suave, the ornaments are given to them; and so the extortions flourish.

"It is to be hoped that the time will come when there will be no more need of giving douceurs to policemen and letter carriers, than to locomotive engineers, or to mechanics, or to readers of gas meters. If it is necessary to piece out the salary of government employes, manufacturers would rather pay in direct tax than endure any more extortion.

"Here comes Dux Bangthorn, the gentle nuisance, who will put your name under a new shingle of the great structure as often as you will give him ten cents. Here, Bangthorn take this dollar, and shingle me ten times, if you don't forget it. How much shall I pay you, per shingle, for the outside, to use as advertising space? It seems to me that the next scheme will be to offer to paint advertisements upon the house-top, in order to raise money to build the house.

"It may be thought an easy matter to dispose of these extortionists without giving them money. I made some experiments in this direction, beginning with the paper carrier. After paying six dollars for a daily paper, I decided not to give the carrier a douceur once or twice a year. I made complaints in person, and wrote to the office for five years before securing the daily delivery of the paper."

And now Gascon surprises me by a story of a gift association that he has formed in his shop, for the purpose of doing away with a gentle and suave extortion that is somewhat too common in machine shops. He states:

"In years gone, it was customary, in my shop, to make presents to men about to leave, or about to be married, to men about to grow old, or about most anything. Those usually singled out to receive the presents were of the kind having a long line of honorable dont's—don't drink, don't chew, etc. Jarno, I have had enough of hearing men praised by giving a list of their dont's, just as if we lived in a time when the best that can be said of a man is that he does not do the things that are done by most other men. When a man is sufficient master of himself to make, in good time, ten or more hardened steel pieces that are without scratches, and vary in size not more than the ten-thousandth part of an inch, he is also master of himself in other ways; the things that he does are of interest, and we need not be over anxious about the things that he does not. That a man is a bundle of dont's, should be no more to his credit than that he has eyes and legs.

"The routine of these presentations was about like this: Some one that wished to be brought into prominence would suddenly discover a rare combination of qualities in a shopmate, and would straightway draw up a subscription paper: 'We the undersigned, earnestly wishing to fitly show our hearty appreciation of your many and genial good qualities in the performance of your various duties,' and so on, *ad nauseum*. Himsefo Ponderoso was an adept at drawing up and out these papers, especially in drawing them out. The paper would be circulated, all in working hours, at a loss to me of more than the cost of the gift. At last I told Ponderoso that, if he would give me timely notice, I would pay for the next gift, and let him have all the honor.

"Then I formed the insurance gift association, which has been a success. Members pay in ten cents a week. When any unusual thing is going to happen to a member, due notice is given, and a present is made—for going away $20.00—for coming back $1.00—being married $40.00.

"Those that do not wish to be in the insurance association can give on the Australian ballot system. Each one, on going out of the shop, takes an envelope from a box, puts in it the amount to be contributed, and, on returning, drops it back into the box. The Australian system has developed some interesting facts. On being opened, many of the envelopes contain nothing. This is not so pleasant to Ponderoso, because his commission in buying the gift is considerably reduced.

"There is a trite saying to the effect that it is better to give than to receive, which must have been started by one that never saw a subscription paper. Many of us have had quite enough of the better, and would now be content with some of the other kind. After having both sides of the experience, we can the more easily judge of either; the very change will give zest to the better side. There are times when one would like to make a present. Some delicate attention has been shown, some kindly help given—so delicate and so kindly that to offer to pay is not in good taste, but this should not be a reason for asking others to contribute. We may also be benefited by persons when even the offer of a gift is an intrusion. There may be cases in which every one that signs a paper does so from choice, but in very many the signing is done, in part, to avoid misunderstandings with shopmates. If drawn up by a foreman, a workman feels as if in some

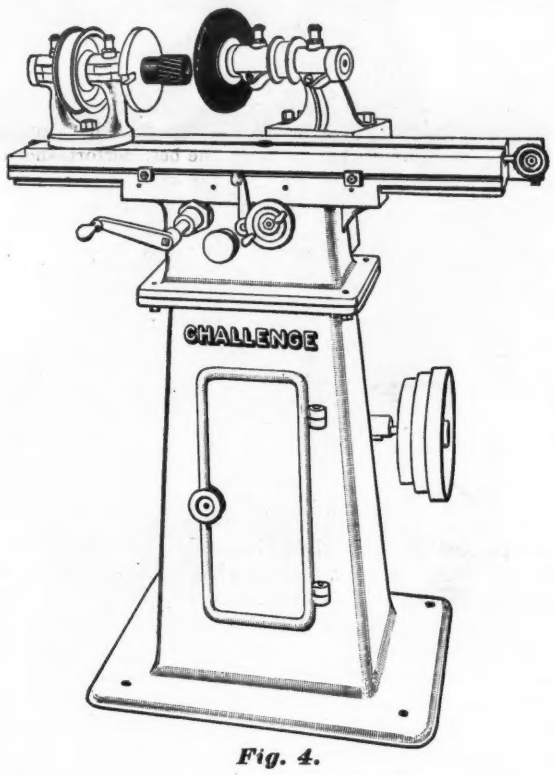


Fig. 4.

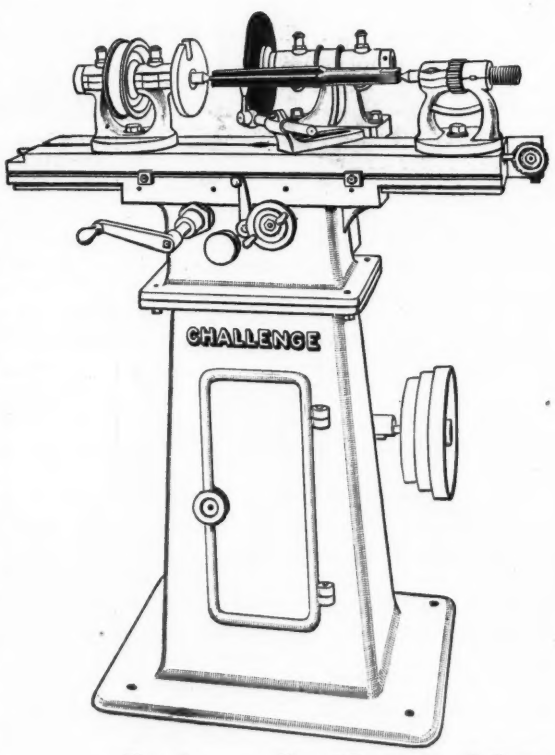


FIG. 5. THE "CHALLENGE" GRINDING MACHINE.—SEE PAGE 4.

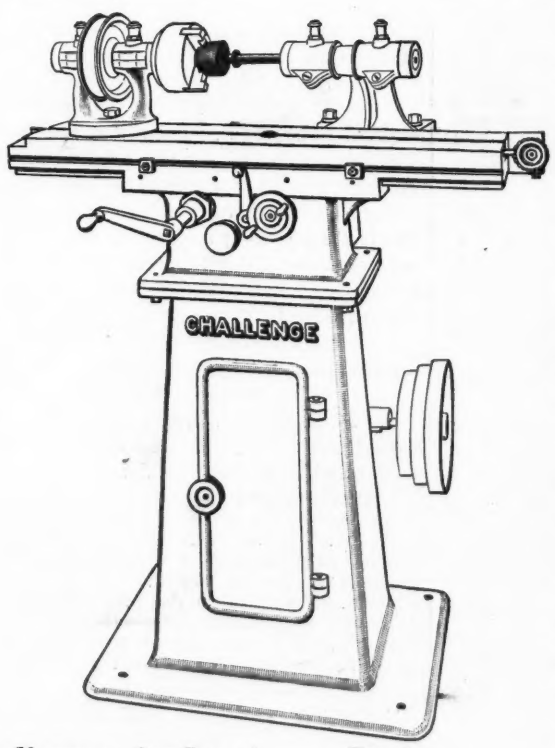


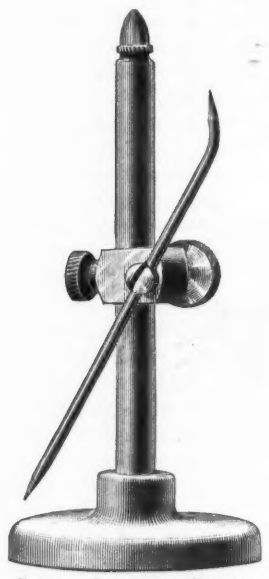
FIG. 6.

way his standing in the shop depends upon the amount of his contribution. The Australian gift system does away with all undue influence and polite extortion, and lets one act freely one's own choice."

These gift systems are so simple and effective that it is a surprise that they were not brought out many years sooner. I almost wish that I had thought of them first. A thing may be brought out by several inventors at the same time. I am much interested to know whether the foregoing is an account of a prior inventor.

A Small Surface Gauge and a Small Tool Grinder.

On this page we give an illustration of a small surface gauge, which is being introduced and sold by Montgomery & Co., New York City. The post of this gauge is only 3½ inches high, with the other parts in proportion, though they are somewhat more heavily proportioned than on larger gauges, in order to give stiffness, and secure reliability. All the parts, except the base, are of steel, the needle being held in a small bolt, which is split, and is of a conical form under the head, so that as the nut is tightened the needle is firmly gripped. A separate screw secures the head to the post. On such a small gauge it has been thought advisable to dispense with adjusting devices, as it is found that the needle is as readily set by light tapping as is a pair of calipers, and it makes



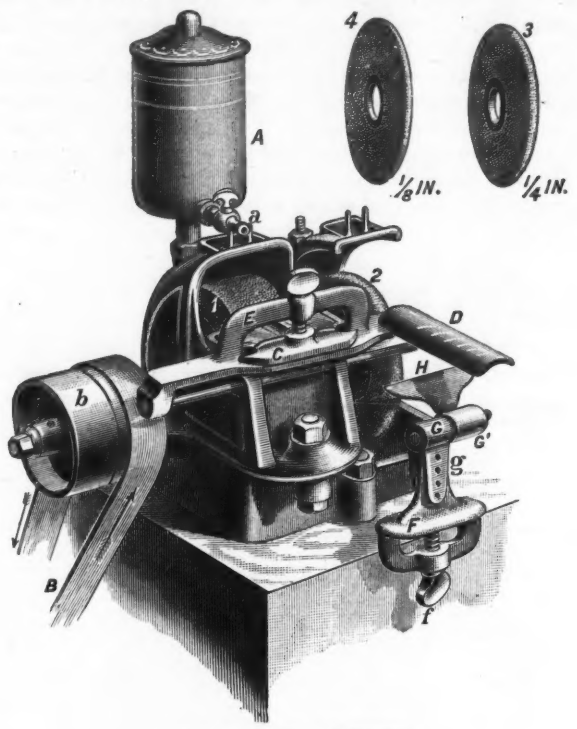
Small Surface Gauge.

the construction more simple as well as making the gauge cost the machinist or tool maker considerably less—a point which he will not be apt to overlook. It is a well-known fact that the contact of a gauge or caliper is more readily felt when the tool which must be manipulated is light rather than heavy, and for this reason, among others, a gauge of this size has advantages for the work which comes within its range, and that is a very large proportion of all the work which comes to many tool makers and machinists. A hole is made through the base, which admits of passing the needle through to be used as a depth gauge, or, where the bent end is used, for a scratch gauge. They are made in quantities by special tools for the purpose of reducing the cost to the mechanic.

The grinder shown on this page is also being introduced by Montgomery & Co. It is called the clipper tool grinder, and is intended especially for pattern makers' use. In this machine a solid corundum wheel 6 inches diameter, with a flat face, is placed between the spindle bearings, while outside of the bearings provision is made for using thinner wheels, which may be of any desired form, but are usually rounded, to adapt them to the grinding of gouge chisels.

The flat wheel in the center is for grinding flat chisels or plane bits, which are placed under the clamping plate *C*, and clamped in place by the screw shown, the bevel given depending upon the distance the chisel projects through the clamp. It is then pressed lightly to the wheel by one hand, while by the other it is moved across the face by means of the handle *D*, a slide being provided below.

For grinding gouges the clamp rest *F* is used, which swings up into position on the



Small Tool Grinder.

pivot *G*, and is also pivoted on a pin which may be placed in any of the holes *g*, thus changing the radius upon which it swings laterally, and adapting it to gouges of any size. three wheels of varying thicknesses being found sufficient to cover the requirements in most cases. The beveled surface of a chisel or plane bit ground upon this machine is concave, which is an advantage where the edge is finished on the oil-stone, because by oil stoning the actual cutting edge becomes straight for a little ways back, and it is much more easily kept sharp by the oil-stone on account of the reduced surface which must be ground away by it. The rest *H* is adjustable, and is intended for general use where tools are ground "free-hand." The water-pot can be placed over either wheel. The wheels are especially adapted to this work, and are guaranteed not to glaze nor to draw the temper of tools when kept wet. As will be seen, the grinder takes up very little room, and we believe will be found a very useful adjunct to almost any pattern shop.

The Philadelphia *Inquirer* makes the following diagnosis of the cause of a recent death of a lineman in New York:

First. He neglected to wear his rubber gloves, and so it was his own fault.

Second. The air was full of moisture, which made everything a good conductor, and so it was nobody's fault.

Third. If every lamp was provided with a "cut-out" there would be no danger in adjusting it, and the absence of this apparatus made the company responsible for his death.

Harland & Wolff, the well-known shipbuilders of Belfast, are building a fast steamship for the Dominion line. She will have accommodation for about 100 saloon passengers, and will be the finest boat going to Montreal. She is to be christened the Labrador, and will make her first voyage in May next.

Italy's New Ironclad.

The new ironclad Sardegna was launched yesterday morning at Spezia, in the presence of the Duke and Duchess of Genoa, the Minister of Marine, and an enormous crowd, which had arrived from all parts of Italy. The launching was perfectly successful, and took place in the midst of the greatest enthusiasm. The Sardegna is of the same type as the two first-class battle ships Re Umberto and Sicilia. The Sardegna is 410 feet long by 77 feet in beam, and has a displacement of 14,000 tons, with a mean draught of 8.73 meters. The hull is entirely of steel. The engines consist of four sets of triple-expansion engines, capable of developing 15,200 horse-power under natural draught, and 22,800 under forced draught, which will drive the ship at a speed of 20 knots. She is fitted with eighteen boilers, placed in six separate compartments. Her chief armament consists of four heavy guns of 343 millimeters and 68 tons weight, mounted in pairs, in two barbettes placed fore and aft close to the central superstructure, each pair being available on both sides of the ship. The secondary armament of quick-firing guns will be eight six-inch guns and four five-inch, with fore and aft fire placed on the superstructure; twelve 120-millimeter guns on the sides of the central redoubt, and a great number of quick-firing and machine guns. The Sardegna is likewise fitted with five torpedo tubes, one astern, two on the sides above the water, and two on the sides under the water. The central redoubt is protected on the sides with four-inch armor plates, which extend from one meter under the water line to the superstructure. The supporting platforms are protected by 33-centimeter-thick plates. A protected deck of from five to eleven centimeters in thickness runs fore and aft over the compartment where the machinery and boilers are placed. The tower is protected by 35-centimeter-thick plates. The ship is fitted with the electric light, and with eight powerful search lights.—*London Daily News.*

LETTERS FROM PRACTICAL MEN.

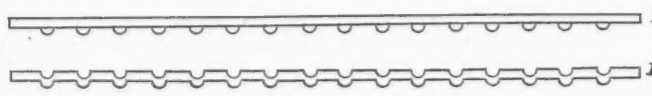
Making Patterns in the Foundry.

Editor American Machinist:

In Question 365, of Sept. 18 issue, N. P. asks for some method of altering patterns without going to the expense of making new ones. As I do not know the size or shape of patterns to be changed, I cannot tell him exactly how to proceed; still, as the principle involved in the following is the same in all similar cases, no matter what the size or shape of the patterns may be, I think it may possibly help him some.

We will take, for example, an iron plate pattern 18″ wide, 36″ long, and ½″ thick. We will suppose he wants to put indentations resembling half the inside of a hollow ball on one side, and half the outside of the ball on the other side. Fig. 1 shows a sectional view of pattern through half balls.

The cheapest way to make these half balls would be to get two pieces of lumber, each half in thickness the diameter of balls wanted on pattern. Glue paper on one side of each, and then glue both papered sides together. Have them turned the correct diameter and



Making Patterns in the Foundry.

split them. They can then be held in place on pattern by a little shellac.

Now, as the working pattern is ready, procure a good stiff flask, and see that the joint of drag part is not twisted. Lay the pattern on a smooth board with ball side up, and put on the drag and raise it above the board, so the joint of flask will be even with the upper side of pattern; in other words, put a ½″ strip under each of the four corners of drag; next, see that your pattern is exactly in the middle of the drag, as everything depends on this. For instance, if the pattern is 18″ wide and 36″ long, and your flask 20″ wide and 40″ long, you will have 1″ of room on each side, and 2″ of room on the ends. Get blocks 1″ and 2″ respectively and place between pattern and flask, so there will be no danger of either moving. Now get some core sand that has no flour or anything in it liable to make green sand stick to it and riddle on pattern; fill in with heap sand, and ram it very tight, roll over and draw the pattern out, cut or blow away any loose sand, or, in other words, make the 1″ room on sides and ends level with top of the core sand pattern, for such it now is. Throw on a little parting sand, put on cope, and set a nail head down in each of the indentations which will lift them. When the cope is lifted off, you will find that you have the top part of mold, which can be finished accordingly. Shake out the drag and place it on follow board as before, but do not put the ½″ strips under the corners. Get the pattern in the same place it was before with blocks, and riddle on facing sand or whatever you like, ram up and roll over, and draw out pattern, after making the joint, you will now have to make up the shrinkage, which, in an 18″x36″, would be, allowing for finishing, ⅛″ on each side, and ¼″ on each end, which can be cut out with a trowel and mended up straight with a small, straight edge. On the mold being closed and cast, you will have a casting similar to Fig. 2. Now the amount of work required to finish the casting will depend a great deal on who makes the casting; a good molder will most likely make a nice casting, which, on the whole, I think will pay better than to leave it to a jerk. Alex. Cairns.

An Experience with Pumps—Worm Gearing—Internal Gearing.

Editor American Machinist:

Some recent experience has convinced me of the futility of expecting accurate determination of the cause of bad working of pumps from men who have not quite a special training and experience.

In the course of some recent correspondence with regard to the bad working of a pump, it appeared, from all one could gather, that the yield of water in a well must be very much less than what it had been pronounced to be by an expert some months ago; and though it was advised to place the pump nearer to the water, a local consulting engineer being also called in, stated most emphatically that the pump was all right, but there was no water to be pumped. At this stage of affairs, matters becoming desperate, the well owners requested I would go down and make a personal inspection of the whole affair, and report accordingly.

To make absolutely certain that the pump should at least not fail to work for want of water, the suction was put down so as to draw from a point fully twenty-eight feet below the pump. On trial it was then shown repeatedly that the pump refused to draw water as much as even fifteen feet, and further inquiry brought to light the fact that the pump bucket was simply a solid block with grooves in it, but *no rings*, and therefore, as it both lifted by suction and then forced the water to a tank, there was much more chance of air passing the bucket than if a valve bucket had been employed working in a closed barrel. Needless to say a good pump bucket would add something like ten feet to the suction power of the pump, and, as this would treble the possible reduction of head of water in the well, the supply may fairly be supposed capable of being nearly doubled. Here, for want of a little

care, a pump maker and an engineer have seriously inconvenienced a man to whom a good supply of water was a necessity; they have further tended to discredit the expert who first stated the well was good for a certain yield of water per hour, and which yield has never yet been obtained. My own conviction is that the expert was perfectly right, for I find some of his figures correct to a nicety, and results point to his statement as to yield being equally sound.

Worm gearing, more than any other type of gearing, seems to be held in very various estimation. It is, however, very largely a question of locality and care. Worm gearing is exceedingly liable to grind itself in pieces when not well lubricated. The ease with which by a worm a big reduction can be effected in velocity of rotation must surely be the only reason for its employment in mechanical stokers. In these machines worms are common, and, I may add, unclean. If oiled, they are quickly dried by coal-dust and grit, and wear away at an enormous rate. In a fairly protected place worm gearing has been run for years to actuate elevators in cotton factories. I have known them thus to run well for years even when only of very poor original design.

One of the various types of steam motors for tramway use in this country is Wilkinson's. Amongst many other ingenious little contrivances which Wilkinson added to his little engines was worm gearing to transmit rotation from a small pair of vertical engines, revolving at a high speed, to the axle of the main drivers which thus revolved at the speed considered sufficient for street traffic. A small engine thus did a large amount of work, and had a big starting power. Further, the engine had a very full control over the wheels, and yet when steam was shut off the wheels would drive the engines round through the worm gearing, the worm wheel actually driving the worm. It is proper to state that the worm was of phosphor bronze, and I believe I am correct in stating it was treble threaded, and so fairly oblique for counter or reverse driving. As usual with tramway motors here, the machinery was all boxed in beneath, so as to be entirely secure from road dust, and the lower half of the worm ran in oil. I have somewhere a drawing of this, and if I can find it will shortly send it on; it may be of interest. My respect for worm gearing possibilities was greatly increased by this.

As a rule, the pressure between the working surfaces is too great for the quality of the lubrication, and the constant grinding in one direction seems particularly calculated to squeeze out the lubricant and cause cutting.

For rapid reduction of velocities between parallel shafts not far apart, internal gearing will often be found applicable where ordinary spur gearing is inconvenient to apply.

Internal gears are far too little employed, and yet their working is in every way smoother and easier than external gears, and they are quite as easy to construct—the internal wheel being the converse of an external spur of equal diameter, etc.

Only recently, in a case where an engine was altogether unequal to its work of driving a certain shaft direct, and yet where it was impossible to move the engine more than three inches, an internal wheel on the driven shaft with a small pinion on the engine shaft effectually overcame all trouble, and allowed the engine to be run at fully three times its previous speed and power. W.H. Booth.

Notwithstanding the fact that cotton mills are being increased wonderfully in the South, New England mills are largely increasing their capacity. There seems to be room for all.

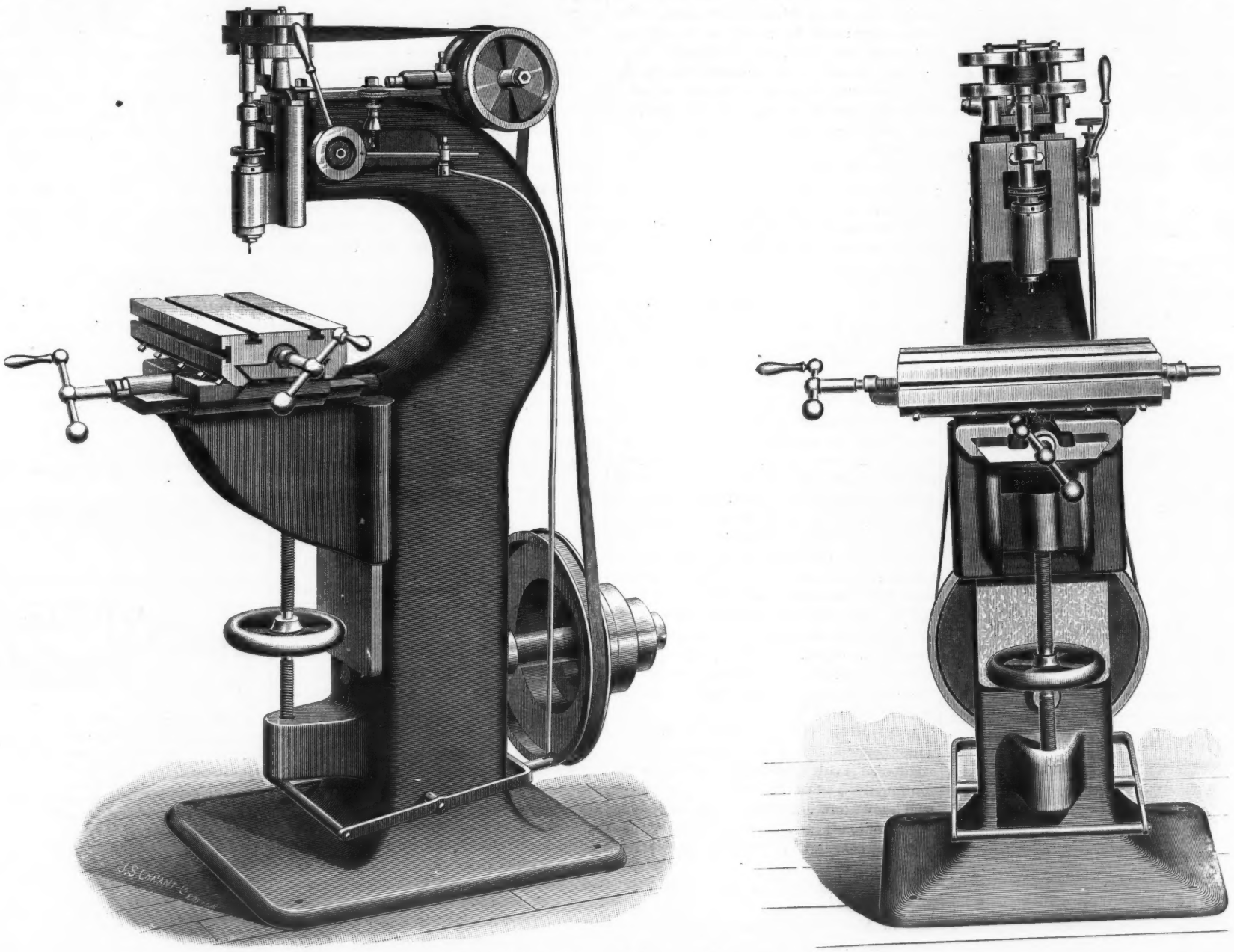
The utility of engineering societies in spreading knowledge in the direction of the work of the members is an important factor in engineering progress. Societies of this kind are increasing remarkably in numbers and membership, and this directly increases their usefulness to the world at large. Members for the most part are men engaged in the active duties of their profession, and through these societies their experience is very freely given—given so as not only to help the members, but the world at large. The publications of such societies form a most valuable part of current literature on engineering topics.

The Becker Vertical Milling Machine.

We give on this page a front and a side view of a new vertical milling machine, which, besides being adapted to the ordinary work coming within its capacity, has special features which fit it particularly for the doing of light, fine work, where small cutters are to be used, which must run at high speeds in order to be efficient. The general construction of the machine will be readily understood from the engravings, there being a column, upon the front face of which is placed a knee that can be moved vertically, and carrying upon its top face two slides, which are at right angles to each other, and are moved by screws and crank handles. The platen upon which the work is placed is 8x16 inches.

The column is carried back in a curve above the knee, to enable work to be done in the center of large pieces of metal (especially sheet brass), and on the face above is a slide which carries the spindle, and which has a vertical motion for the adjustment of the cutter to its cut, this motion being effected either by the hand lever shown, or by the treadle below, leaving the hands free to control the movement of the platen. A stop is provided by which the cutter may be set to the same depth after having been for any reason taken out of the work, and the slide is counterbalanced by a weight within the column.

Where a machine of this character is used for brass or other soft metals, and with small cutters, down to say ¼ inch diameter, difficulty is usually experienced in attaining a speed sufficiently high to make the cutters work well, and, if it is attained, then it is often found that the bearings of the spindle do not work well, but persistently heat. Much of this difficulty, it is found, is overcome by relieving the spindle of all side strain caused by the belt. In this machine this is accomplished by mounting the belt pulley in such a way that its axis rests upon the rims of four other pulleys, as shown, and the cutter spindle is a separate thing driven by a splined sleeve in such a way that no side strain whatever comes upon it by reason of the pull of the belt. The spindle itself is hardened and ground inside and out (the taper hole being made to fit the shanks of the Brown & Sharpe end mills), runs in aluminum bronze boxes, and it is found that it can be run at a speed of 10,000 revolutions per minute without trouble. A cutter ⅛ inch diameter, cutting through brass or composition ¼ inch deep, and driven at a speed of 8,000 revolutions, will cut 10 inches per minute easily and without danger to the cutter or machine. The high speed at which it can be run (over 10,000 revolutions per minute when required) makes it specially well adapted to metal engraving, as the most delicate cutters can be used with success. The countershaft has two speeds, 100 and 700 revolutions, the slower one for the larger cutters and for steel work, the machine being adapted to use end mills up to 2½ inches diameter. Weight of machine about 1,100 pounds. It is built by the John Becker Mfg. Co., 157 Pearl street, Boston, Mass., and may at present be seen in operation at the Mechanics' Fair in that city.



The Becker Vertical Milling Machine.

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NEW YORK, OCTOBER 23, 1890.

CONTENTS.

PAGE.

A Large Drawing Press..... 1, 2
History of Attempts to Determine the Relative Value of Lubricants by Mechanical Tests. By Professor J. E. Denton.....2, 3, 4
The "Challenge" Grinding Machine..... 4
Final Work of the Local Committee. N. A. S. E. 5
Moods—Extortion—The Gift Association. By Jarno..... 5, 6
A Small Surface Gauge and a Small Tool Grinder..... 6
Italy's New Ironclad..... 6
Letters from Practical Men: Making Patterns in the Foundry. By Alex. Cairns—An Experience with Pumps—Worm Gearing—Internal Gearing. By W. H. Booth..... 6, 7
The Becker "Vertical" Milling Machine..... 7
Who Should Attend to Details?..... 8
Literary Notes..... 8
Questions and Answers..... 8, 9
Manufactures.....9, 10
The Foreign Iron and Steel Men..... 10, 11
Opening of the Colleges of Mechanical and Electrical Engineering—Cornell University..... 12
Machinists' Supplies and Iron..... 12

Who Should Attend to Details?

Last week we published a letter which described in a vivid manner that unfortunate individual who, placed in a position of responsibility—in general charge of a machine shop, for instance, where there are numerous minute details to be looked after—thinks that he himself must individually look after every one of them, or nothing will go right. We have all met such men, for they are to be found in all parts of the country, holding positions as foremen of departments, superintendents of shops, or master mechanics of railroads.

If you were to ask one of these men if he thought that he was the only man about the place that knew his business, or cared anything about knowing it, he would probably look at you in astonishment, for, as a matter of fact, he does not deliberately think anything of the kind; yet he goes on day after day, and month after month, acting just as though, if there was but one conviction which was firmly settled in his mind, it was that no one could be trusted to do anything whatever, just right, except himself. Such men are usually well meaning enough, but they are simply so constituted mentally as to be unfitted for the management of affairs of any magnitude, and they usually drop out voluntarily or otherwise as soon as a business attains such proportions that its details become too numerous to be attended to by any one man, to be succeeded by a man who, however capable he may be of attending to details, knows that a general manager of a large business must not do it, but must gather about him men who can attend to them, and whose business it is to do it, leaving him free to give his entire attention to larger affairs, and to general supervision.

And it is all the more unfortunate for the first-mentioned class of men that the course pursued by them is the very one which is best calculated to gather about them men who must be continually guided and instructed in every detail. A man who feels himself master of his trade or profession usually dislikes to be continually instructed in petty details of it, which are already familiar to him; and, if he is properly constituted, will seek employment where some responsibility is thrown upon him; while one who is less competent and less sure of himself is best suited in a position where some one else directs his every movement, down to the smallest detail. And thus, by a process of natural selection, the foreman or manager who has the habit of interfering, and concerning himself with small affairs which can be better left to others, is likely to gather about him a set of men who are frightened at responsibility, and must be continually guided and directed; while he who knows how and when to throw responsibility onto others attracts or develops men who can bear it, and who take pleasure in the bearing of it.

It is related of the elder Vanderbilt, that a man who was in charge of the freight business of his railroad came to him one day and asked him what he should do with regard to a certain matter which had arisen pertaining to his department. Vanderbilt plainly told him that the man who occupied his position, and received his salary, was supposed to be capable of deciding such matters. The man did decide it, and decided it wisely, while the story furnishes a key to Vanderbilt's success. As president of the road he was willing to, and did assume the responsibilities of that position, but if his master mechanic had come to him to ask what type of locomotive should be adopted for certain service, the probabilities are that there would have been a new master mechanic; and it ought to have been equally hazardous for a shop foreman to ask the master mechanic how closely a piston should be fitted, or for a machinist to ask the foreman how to caliper a driving axle for the wheel fit.

We often see men in charge of small affairs who seem always so busy as to be on the verge of distraction, while others in charge of similar establishments of much greater magnitude seem always to have abundance of time, and to spare. It sometimes happens that there is some special or peculiar reason for this, but, in the absence of such reason, the explanation is usually to be found in the fact that there is on the part of the over-busy man a failure to discriminate between those things which he should himself attend to, and those which should be relegated to others. Where any man, no matter how great his abilities, attempts to personally attend to every minute matter in connection with an industrial establishment, the limit of his capacity is soon reached, while there is scarcely any limit to the magnitude of the establishment that can be successfully managed by the man who understands how to choose or develop assistants, and how to place responsibility upon them.

A press dispatch contains an account of an act of heroism by a railroad engineer, which, if true, entitles him to be ranked high among the world's heroes. With the usual inaccuracy of press dispatches, the name of the engineer is given in one place as Edward Murphy and in another as William Murphy, but at any rate Murphy was in charge of an engine which was pulling a Chicago & Erie west-bound freight, when the boiler exploded, and he, badly scalded, jumped to the ground, breaking his leg. The first man to arrive at the scene found him crawling up the track with a lantern, to flag a vestibuled passenger train which was then due, and which, by his presence of mind and magnificent nerve, was stopped at the entrance to the cut in which the wrecked engine was standing.

Trainmen are constantly forgetting to protect their trains by flagging when stopped upon the road, even under ordinary circumstances, and no one could have blamed engineer Murphy if he had forgotten it when suffering the agony of severe scalds and a broken leg. He not only knew and remembered what to do, but did it under circumstances which prove him to be a most noble hero.

Literary Notes.

HAND-BOOK OF CALCULATIONS for Engineers and Firemen, relating to the Steam Engine, the Steam Boiler, Pumps, Shafting, etc. By N. Hawkins, M. E., Honorary Member National Association of Stationary Engineers; Editorial Writer, Author Maxims and Instructions for the Boiler-room.

This book is intended for the use of firemen, engineers and machinists. The aim of the author is to put in a compact form, and within the reach of practical men who have had but comparatively little or no theoretical training, rules for the solution of problems relating to the steam engine and boiler, the steam pump, shafting and pulleys, and all other calculations required in the varied duties of steam engineering. The opening parts teach first how to write and read figures, and from this primer-like commencement the work proceeds to give the elements of arithmetic, mensuration, geometry, algebra, etc., all illustrated with examples of calculations relating to every-day problems of the engineer. In excuse for the extreme simplicity of some of the problems presented, the author says, in the introduction of the book, that this feature was incorporated in it on account of his knowledge ascertained from a member of the board of U. S. government examiners, some years since, that some score of high class marine engineers had come very near losing their positions on account of their ignorance of many of the simplest items of information relating to their duties. The book also treats on mechanics, in which the primary powers, such as the lever wheel and axle, the pulley and inclined plane, are described and illustrated with many examples. Next follows as general subjects the elements of thermodynamics, or the mechanical theory of heat. The horse-powers of engines and boilers are treated on, rules for computing the same are given, and followed by notes on pumps, steam, injectors, gravity, strength of material, and the safety valve, with the solutions of problems relating to it. A few notes relating to the different classes of engines are given, followed by the mechanism of some of the principal parts of the steam engine, and description of the engine counter. The book also touches on illuminating gas, and how to read the gas meter; gives tables of melting points of solids, and electrical data and definitions. It contains a table of sizes for chimneys, also rules for calculating the transmission of power by belting. The indicator is illustrated, and rules for figuring the diagrams are given. The complete index adds value to the work, and the whole will undoubtedly be appreciated by those for whom it is written. The book is published by Theodore Audel & Co., 91 Liberty street, New York. The work may be obtained in ten parts at 25 cents each, or in book form at $2.50.

HANDY LISTS OF TECHNICAL LITERATURE. A Reference Catalogue of Books printed in English from 1880 to 1888 inclusive, to which is added a Select List of Books printed before 1880, and still kept on Publishers' and Jobbers' Lists. Compiled by H. E. Haferkorn and Paul Heise.

This catalogue contains a list of books relating to engineering and mechanics, comprising applied and theoretical mechanics, machinery, steam and marine engineering, railroad building, construction, engineering, management and practice; civil engineering, surveying, leveling, hydraulic and sanitary engineering, sewerage and drainage, etc., mechanical drawing, together with a supplementary list of periodicals and annuals in these branches. The main entry of each work will be found under the author's name, containing full title, year of issue, publisher's or agent's name, editions and price. The publisher or distributing agent of each book is indicated by a system of abbreviations, at the end of the entry, which are explained in a key, containing a list of all publishers and agents representing this part.

It is scarcely necessary to say that a catalogue of this kind is invaluable to the engineer, mechanic or student, as it enables him almost at a glance to locate any and all treatises upon any of the topics embraced within the above branches. The catalogue is published by Heise & Haferkorn, 274 Grove street, Milwaukee, Wis. The price of the catalogue is $2.50, and the price of the key is 25 cents.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(409) S. M. C., ——, writes: Please give the average consumption of ordinary block coal per indicated horse-power in a power station using from 60 to 100 horse-power, with modern engine and boiler. Also, how much water should be evaporated per horse-power in the same station? *A.*—We cannot give the consumption of coal per horse-power unless we know more about its quality. Compound condensing engines from 60 to 100 horse-power are run with 2 to 2½ pounds of good coal, and with an evaporation of 18 to 22 pounds of water per horse-power.

(410) A. G., Brooklyn, N. Y., writes: I am running a small engine of the following dimensions: Bore of cylinder, 7 inches; stroke, 9 inches; cut-off at two-thirds of the stroke; number of revolutions, 100. We wish to increase our power three or four horse-power. We cannot run the engine any faster, on account of some of the machines, and to change the pulleys and several gears throughout the shop would cost considerable at this time of the year. Now I propose putting on a cylinder two inches larger in diameter to accomplish the desired result. The crank-pin is 1⅞ inches diameter and 2 inches long. The crank-shaft is 3 inches diameter, and the bearings are 6 inches long. Are the bearings, pin and crank-shaft large enough for the larger cylinder? *A.*—The bearings, crank-pin and shaft are not large enough for the 9-inch cylinder, for which you will need a shaft 4 or 4½ inches diameter, and a crank-pin not less than 2 inches diameter. The only way to increase the horse-power is either to speed up the engine or get a new one.

(411) J. E. P., West Chester, Pa., writes: A. and B. wish you to settle a dispute. A. says that if the cards taken from the two ends of an engine cylinder are exactly alike, the power developed on the piston, and hence that transmitted through the connecting rod and crank to the main shaft, are equal during the two strokes. B. admits that the powers developed on each side of the piston are alike, but, owing to the different leverages on the crank, claims that there is more power transmitted to the shaft in the forward stroke than in the backward stroke. *A.*—Although the leverage with which the steam pressure acts during one stroke varies at different positions of the crank, the same variations occur in both strokes, and we may therefore say that the leverage is the same for forward and backward stroke. In an indicator card the ordinates of the curve represent efforts, and the abscissas represent distances through which the efforts are exerted. The area of the card, therefore, represents the product of effort and distance, or the work done by the piston. For the crank-pin, it is an easy matter to lay out a curve whose ordinates represent resistances, and the abscissas represent the distances through which the resistances are overcome; therefore the area of such a diagram also represents work; that is, the work taken up by the crank-pin. If we now neglect friction, we have a right to say that the work done by the piston must be exactly equal to that taken up by the crank-pin, so long as the velocity of the crank-pin remains uniform. Now if both indicator cards are exactly alike, they represent an equal amount of work performed, and since the crank-pin takes up that amount of work, it follows that there is no difference between the power of the forward and backward stroke. Here, of course, we have omitted the small difference between the area of the two sides of the piston due to the piston rod, or, in other words, we have assumed that the piston rod passes through both cylinder heads.

(412) C. P. S., Ishpeming, Mich., writes: Please inform me at what point of the stroke the steam pressure is the highest. *A.*—Generally at or near the beginning of the stroke. 2. Should the eccentric stand at right angles to the crank when the latter stands on a dead center? *A.*—That will depend on the amount of lap and lead. When the valve has no lap and lead, the eccentric will stand at right angles to the crank; if it has lap and lead, then the distance from the center of the eccentric to a line drawn through the center of the shaft perpendicular to the crank must be equal to the lap and lead. These rules will hold true only in cases where the axis of the cylinder, the center of crank-shaft and the line of motion of the valve gear lie in the same plane. 3. How do you compute the average pressure on the piston? *A.*—Find the ratio of expansion, add 1 to the hyperbolic logarithm of the ratio of expansion, divide the sum by the ratio of expansion, and multiply the quotient by the initial absolute steam pressure; the product will be the mean pressure per square inch on the piston. Subtracting the absolute back pressure from the mean pressure, the remainder will be the mean effective pressure per square inch. To illustrate: Let the initial pressure be 90 pounds by the gauge, and steam cut off at $\frac{1}{3}$ of the stroke. The ratio of expansion will be $\frac{3}{1} = 3$; the hyperbolic logarithm of 3 is 1.099; adding 1 we have $1 + 1.099 = 2.099$; dividing by the ratio of expansion, we have $\frac{2.099}{3} = .699+$. This is to be multiplied by the absolute steam pressure. The absolute steam pressure is equal to the sum of the steam pressure by the gauge and the atmospheric pressure, 14.7 pounds; therefore the absolute steam pressure is $90 + 14.7 = 104.7$ pounds; and $.699 \times 104.7 = 73.1853$ pounds mean pressure per square inch of piston. If, now, the back pressure per gauge is 5 pounds, then the absolute back pressure will be $5 + 14.7 = 19.7$ pounds, and the mean effective pressure per square inch of piston will be $73.1853 - 19.7 = 53.4853$ pounds. It may be stated here that tables of the hyperbolic logarithm of numbers are published in engineers' pocket-books or works treating on steam and the steam engine. 4. Is double the lead sufficient for the lap of the valve? *A.*—The lap of the valve is not found by the lead; the lap depends on the cut-off. See article treating on the proportions of the steam ports and a D slide valve, in our issue of May 1, 1890.

(413) F. M. F., Corry, Pa., asks: Does the valve in a direct-acting link motion lose lead in all cases when the link is hooked up? Also, does the valve gain lead in an indirect link motion? *A.*—We assume that by a direct link motion you mean one in which the link is attached directly to the valve stem; and by an indirect link motion, one in which a rocker is interposed between the link and valve stem. Under these conditions we answer that the valve may gain lead or lose it in both cases, and whether it is to be the former or the latter will depend on the manner in which the eccentric rods are connected to the link. This can be proved graphically. Fig. 1 shows, according to the above definitions, a direct link motion, in which, for the sake of simplicity, the mechanism is represented by center lines only. In this case the valve and its seat should have been placed on the line $L\,h$, but that would interfere with the clearness of the illustration; we have therefore shown the valve at a convenient distance above the link, and since this is simply a matter of convenience, the distance from the line $L\,h$ to the valve seat may be any distance. But not so with the horizontal distance from the center of the valve seat to the center c of the crank-shaft; this distance is a definite one, and how to find it will presently be seen. The circumference $f\,b$ represents the path

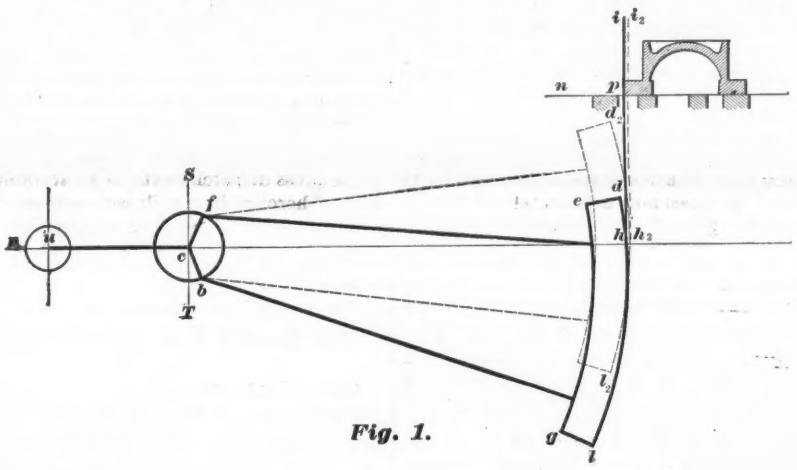

Fig. 1.

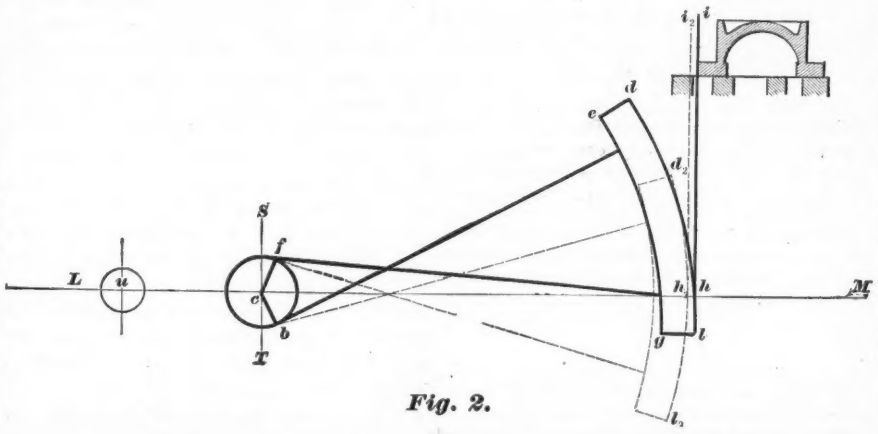

Fig. 2.

of the centers of the eccentric; the point f represents the center of the forward eccentric, and b, the center of the backward eccentric; the line $u\,c$ represents the center line of the crank; u, the center of the crank-pin on a dead center. The line $S\,T$ is drawn perpendicular to the crank, and the distances from f and b to $S\,T$ are equal to the sum of the lead and lap of the valve. The arc $d\,l$ represents the link arc, that is, an arc drawn through the center of the link opening; and the arc $e\,g$ represents the arc in which the centers of the eccentric rod pins are located; the lines from f and b to the arc $e\,g$ represent the center lines of the eccentric rods. The full lines show the link motion in full gear, and the dotted lines show the link motion in mid-gear. When the link motion is in full gear, or in mid-gear, or in any intermediate position, the point of intersection h on the line $L\,h$ and the arc $d\,l$ will always represent the position of the center of the valve rod pin; and since the distance between the valve rod pin and the slide valve is constant, it follows that if we know the position of the former, we also know the position of the latter. Through the point h in which the arc $d\,l$ cuts the line of motion $L\,h$, draw a line $h\,i$ perpendicular to $L\,h$; and since the arc $d\,l$ represents the link in full gear at the end of a stroke, we lay off on the horizontal line n a point p whose distance from the line $h\,i$ is equal to the lead with the link in full gear. Here, then, the point p is the outer edge of a steam port which determines the position of the valve seat on the line n; the line $h\,i$ is assumed to contain the edge of the valve. Now let the link be moved into mid-gear as indicated by the dotted lines. In this position the link arc $d_2\,l_2$ intersects the line $L\,h$ in the point h_2; through this point draw the line $h_2\,i_2$ perpendicular to $L\,h$. It will be seen that the line $h_2\,i_2$ is further away from the point p than the line $h\,i$, and consequently the lead is increased. Here, then, we conclude that as the link is moved up the lead gradually increases. It will be noticed that in this diagram the eccentric rods occupy what is called an open position. Now assume that the eccentric rods are crossed when the crank occupies the same position as shown. This state of affairs is illustrated in Fig. 2. Here we notice that by crossing the rods we change the position of the link; for instance, in Fig. 1 the link is down when the crank moves in the same direction as the hands of a watch, and in Fig. 2 the link is up when the crank moves in the same direction as before. Now let us examine the effect on the lead. Through the point h draw line $h\,i$ perpendicular to $L\,h$, and from $h\,i$ lay off the edge of the port, making the distance from $h\,i$ to the edge of the port equal to the lead. Now let the link be moved into mid-gear as indicated by the dotted lines. Through the point h_2 draw a line $h_2\,i_2$ perpendicular to $L\,h$. The line $h_2\,i_2$ now passes along the outside of the port, which indicates that when the link is in mid-gear the lead has not only been decreased, but the valve has lap at the beginning of the stroke. In an indirect link motion similar results will follow by changing the position of the eccentric rods. We have therefore proved graphically the truth of the assertion made in the beginning, that the lead may increase or decrease by moving the link of either link motion into mid-gear. These results may often be turned to good advantage. For instance, in locomotives the eccentric rods must be so connected that the lead increases. In hoisting engines it is often found advantageous to connect the eccentric rods so that the lead will decrease, and the valve to have lap at the beginning of the stroke when the link is in mid-gear; in this way the engine can be quickly stopped by simply moving the reverse lever without touching the throttle lever. In a valve motion with a stationary link the lead is constant.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Friday morning for the ensuing week's issue.

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For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

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"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th st., New York.

MANUFACTURES

An electric light plant will probably be erected at Orlando, Fla.

The Ocala Ice Co., Ocala, Fla., has increased its capital stock to $50,000.

The Gower Pen Works, now in Montreal, will remove to Plattsburg, N. Y.

The McGuire Machinery Company has been formed at Chicago, Ill.; capital, $22,000.

A $30,000 mill for the manufacture of straw paper will be built at Oak Cliff, Dallas, Tex.

The Rodney Hunt Machine Company, Orange, Mass., is being run 16 hours a day to keep up with orders.

Geo. H. Biegel, of Ponchatoula, La., will put up a cotton-gin, grist-mill and excelsior machine next spring.

There is a project to organize a $200,000 stock company to erect a new fertilizer factory at Augusta, Ga.

Efforts are being made to organize a stock company to build a foundry and machine shop at Carrollton, Ga.

A $100,000 stock company is reported as having been organized, to erect an implement factory at Seymour, Tex.

Another roller-mill, with 100-barrel capacity, will probably be put in at Seymour, Tex. Negotiations are in progress.

Perkins Brothers, Bridgewater, Mass., have completed and started their wire-mill with 100 tons capacity per month.

New York and Washington parties are, it is stated, negotiating with a view of establishing iron works in Winston, N. C.

The city council of Plaquemine, La., is considering a proposition for constructing water-works and erecting an electric light plant.

There is talk of forming a stock company for the purpose of locating a cotton factory at the old Rock Island mill, near Charlotte, N. C.

Negotiations are reported as having been closed for the establishment of stove works and foundry and machine shops at Ivanhoe, Va.

The South Boston Iron Works, at South Boston, Mass., are to be removed to Middleboro, Ky., where they will occupy a building 1,400x150 feet.

F. C. Chase, of Fernandina, expects to organize, in Jacksonville, Fla., the sub-company of the Safety Electric Light Company, of Boston, Mass.

The Robertshaw Brass Foundry Company, at Covington, Ky., has been incorporated by T. S. Robertshaw and J. C. Miller, of Cincinnati, Ohio.

The citizens of Berlin, Wis., have subscribed $50,000 for the Putnam Stove Company, and will give a bonus of $2,000, so the company will not leave the city.

The Waxahachie (Tex.) Electric Light Company is reported as having increased its capital stock to $18,000, and to put in new machinery to enlarge its plant.

The J. N. Sarborough Manufacturing Company, of Americus, Ga., will be organized, with a capital stock of $100,000, to manufacture automatic car brakes.

The Proctor Steel Tower Company, of Chicago, Ill., has been incorporated, to erect and operate towers for scenic and scientific purposes; capital, $2,000,000.

The Detroit Plumbers' Supply Company has been organized, at Detroit, Mich., with a capital of $20,000, to manufacture plumbers' goods and sanitary specialties.

The Phœnix Iron Works, Cleveland, Ohio, are compelled to extend their capacity. They will, in a few days, determine on location, and proceed to erect extensive works.

L. A. Leonard, representing a Chicago (Ill.) syndicate, is reported as endeavoring to organize a stock company to erect works in Chattanooga, Tenn., for manufacturing fuel gas.

The American Fiber Company has been incorporated by C. H. Adams, J. J. Barr and others, to manufacture defibrating machinery at New Orleans, La.; capital, $300,000.

The machinery of the oil-mill at Caldwell, Tex., is being rapidly put in place, and it will soon be in operation. It is a ten-ton mill, with a capacity of being doubled at very little expense.

The Higgins Manufacturing Company, of Beaumont, Tex., with a capital of $50,000, has been chartered, and will immediately procure machinery and commence the manufacture of brick.

The iron foundry and plow works of the C. P. McWane Plow and Foundry Company have been purchased by the Graham Land and Improvement Company, and will be removed to Graham, Tex.

M. M. Rogers, L. L. Powell, W. S. Gooch and others will, it is reported, organize a stock company, to erect a plant at Roanoke, Va., for the manufacture of the Woolly patent electric motor.

The extensive ladder factory at Rumney, N. H., is engaged on an order for twelve car-loads of ladders, and a new factory is to be established at Rumney, or elsewhere, to meet the increased business.

H. C. Cooper and S. T. Griffith, of Bedford City, Va., W. Duke, of Durham, and others, purchased 1,000 acres of land in and around Mount Airy, N. C., and intend, at a later date, erecting an electric light plant, mills, etc.

Last week a charter was granted to the Pittsburgh Malleable Iron Company, Pittsburgh, Pa., to operate with a capital of $25,000. The directors are: Frank Moore, T. R. McGinley, George Rollins, F. W. Seimon and F. B. Atterbury.

The Billings & Spencer Co., Hartford, Conn., have issued a new price list and discount sheet to the hardware trade; also a circular letter to their customers, making a change in the manner of crediting discounts on their goods.

The new shoe factory of Kimball Brothers, East Manchester, N. H., is practically completed; and at Littleton a shoe factory is to be started, with the aid of Boston capital, which will employ 300 hands and turn off about 2,000 pairs per day.

The new cotton compress at Dublin, Tex., is nearly finished. It is a large, substantial structure, built of heavy timbers, and will cover about 10,000 square feet of ground, not including the large platform, which will be 200 feet long and 50 feet wide.

The site of the former glove factory at Warner, N. H., owned by the Boston Boot and Shoe Company, has been purchased by the new Merrimack Glove Company, and a new factory will be erected on the spot for the manufacture of gloves and coats.

H. M. Atkinson, J. H. Porter, John L. Hopkins and others have incorporated the Atlanta Electric Illuminating Company, at Atlanta, Ga., to erect a plant for furnishing electricity for lighting and power purposes. It is said that about $250,000 will be invested in works.

The Mason Regulator Co., Boston, Mass., has issued a new illustrated catalogue of steam-regulating devices, such as reducing valves, pump pressure regulators, damper regulators, pump governors, valves, etc. The cuts and descriptions give an excellent idea of these.

A gentleman of large means and ability came to this city [New Birmingham, Tex.,] on Monday last to look out a point for a rolling-mill. We are informed that he has made satisfactory arrangements, and will put up an extensive plant between this city and Rusk, about 800 yards from either city.—New Birmingham *Times*.

The Rich Patch Iron Mining Company has been incorporated, for buying and selling mineral and timber land, for transacting a general mining business, and to erect furnaces for the manufacture of iron, and for buying and selling ores, coal and coke. The office of the company is to be at White Sulphur Springs, W. Va. Paid-up capital, $500,000, with the privilege of increasing to $1,000,000.

The Moore & White Company, Philadelphia, manufacturers of friction clutch pulleys, cut-off couplings, etc., are putting up one-story brick buildings at Fifteenth street and Lehigh avenue, that city, near Germantown Junction, for their own use. The main building will be used as a machine shop, and is 60x230 feet. The pattern making and wood shop is 60x60 feet, and the blacksmith shop is 40x50 feet.

There seems to be a tendency among machinery establishments in Philadelphia toward moving out to the neighborhood of Germantown Junction, which is within the city limits, and seems especially well adapted as a manufacturing and distributing point, through its Pennsylvania Railroad and Philadelphia & Reading Railroad connections. Three well-known concerns are just now in the procession.

The contract for the steel plant, in Ashland, Ky., has been awarded to Mackintosh, Hemphill & Co., of Pittsburgh, Pa. Work on the plant is to be commenced at once and completed July next. In addition to the buildings necessary for the works proper, there will be a wharf boat and incline, a large depot and other buildings. The plans are so arranged as to admit of any addition that may be required.

The Love Manufacturing Company's plant at Rochester, Pa., was sold on the 27th ult. to Charles Davidson, superintendent of Frick's coke works, at Connellsville, for $14,500, subject to a mortgage of $8,000. This is $2,500 less than was bid the Monday previous. A small amount of real estate in New Castle was also sold. It is not yet known whether the works will be operated at Rochester or removed elsewhere.

The Sharon Steel Casting Company, of Sharon, Pa., is making a number of extensive improvements that will more than double the present capacity of its plant. A new molding-room, 100x100 feet, is being added, which will give employment to about 20 additional molders. The company makes a general line of steel castings in any size from one pound up to fifteen tons, and is at present giving employment to about 200 men.

The Cardiff Rolling-mill Co. is the name of the $200,000 stock company organized at Cardiff, Tenn., by M. M. Duncan, H. C. Young, C. P. Moore and others, to manufacture sheet-iron and sheet steel. The works will include a puddle mill building 125x250 feet, to contain 12 puddling furnaces, and one heating furnace with double train and squeezers, and a sheet-mill building the same size, to contain three trains of sheet rolls, with necessary annealing and heating furnaces. The capacity is to be 1,500 tons of sheet-iron and sheet steel per annum.

Dispatches from Porter, Ind., say: The Anglo-American Parlor Car Company, composed of English and American capitalists, have recently purchased 300 acres of land, and it is expected they will be ready to begin work soon. The company is incorporated for $15,000,000, and will be the largest concern of its kind in the country. M. C. Meagher, president of the Chicago Porter Home Investment Company, was commissioned to make the purchase, and has received a number of inquiries from manufacturers in regard to locating here.

Thos. H. Dallett & Co., 1305 Buttonwood street, Philadelphia, well known to our readers as manufacturers of portable drills, boiler shell drills, hand drills and similar specialties, and now also making electric motors, are putting up a two-story machine shop, brick building, 123x86 feet, at Sedgley avenue and York street, near the 23d street station of the Reading R. R. They expect to get their power plant, and some additions to their machine tool outfit, completed in time to move in about Jan. 1st. They will have a side track connection with the railroad.

There is water-works agitation in Lancaster, Pa.; Alexandria, La.; Westfield, Pa.; Madison, Ill.; Dover, N. J.; Chambersburg, Pa.; Belvidere, Ill.; La Grange, Ga.; Chicago, Ill.; Atlanta, Ga.; Butte, Mont.; Savannah, Ga.; Mason City, Ill.; Tarboro, N. C.; Buena Vista, Ga.; Westchester, Pa.; Meriden, Conn.; Rochester, N. Y.; Grenada, Miss.; Goshen, Ind.; Mishawaka, Ind.; River Forest, Ill.; Oconto, Wis.; Lexington, Neb.; Water Valley, Miss.; San Angelo, Texas; Hingham, Mass.; Hebron, Neb.; Fargo, Dak.; Parkersburg, Pa.; Benton Harbor, Mich.; Wilton, Iowa; Waterbury, Conn.

The removal of the Westinghouse Air-brake Company from Allegheny City to Wilmerding, Pa., is now completed. The shops in Allegheny City are now occupied by the Fuel Gas and Manufacturing Company, another Westinghouse concern. A few days ago the last complement of air-brake workmen left for the new shops in Wilmerding. The general offices have also been located near the new works, while the company's city office is located in the Westinghouse Building, corner of Ninth street and Penn avenue. The new works at Wilmerding are now in full operation, and, owing to the increased facilities, the output of the company is now much larger than formerly.—*American Manufacturer*.

A Lakeland (Fla.) correspondent sends us the following in regard to that town: Our town, which is only in its infancy, has now two completed railroads, and one more in course of construction, leading through the greatest timber and phosphate fields in the State. Mr. Harry C. Sloan, formerly of Austin, Minn., will soon commence the erection of an electric light plant here, and C. D. Clough, late of Montgomery, Ala., will, as soon as satisfactory arrangements are completed, place a large ice factory here. Mr. J. E. Griffin, of Quitman, Ga., will also establish a large saw-mill and manufactory here, to employ about 100 hands. Lakeland is one of the healthiest places in the United States, in the center of the "orange belt," and lake region of Florida, and has now about 1,000 inhabitants.

A press dispatch says: Articles of agreement of the American Brewing Association, of San Francisco, were filed yesterday. The purposes of the association are "to conduct a brewery for the manufacture of beer and malt liquors, buy and sell lumber, conduct a bottling and cooperage business, equip and navigate steamers and sailing vessels, purchase and hold shares of stock of other concerns, and buy and sell real estate." The association is incorporated for 50 years, with the following directors: Adolphus Busch, St. Louis; John A. Hooper, San Mateo; James Phelan, A. B. Spreckels, Charles A. Zinkand, Herman Liebes and I. B. Brandt, of San Francisco. The capital is $3,000,000, of which $500,000 has been subscribed. It is proposed to erect one of the largest breweries in the world, to be in operation in about a year.

A Philadelphia paper says: Architects Geissinger & Hale, of No. 1200 Chestnut street, who prepared the drawings for the wall paper factory of Carey Bros., at Tenth street and Susquehanna avenue [Philadelphia], which was destroyed by fire last June, have completed the arrangements for the rebuilding of the factory. To-day a large force of men will be put to work at clearing away the debris, preparatory to beginning work upon the building proper, which will be erected upon the old foundation walls, which, upon inspection, proved to be in excellent condition. The architecture of the new plant is similar to that of the destroyed buildings, except that the structures at the west side of the lot will be raised from two and three stories to five stories in height. This portion of the work will be prosecuted as rapidly as possible, so that the firm can occupy them while designing patterns, and otherwise preparing to resume work, by February.

The Foreign Iron and Steel Men.

After considerable sight-seeing by the way, at Philadelphia, Johnstown and other places, the members of the Iron and Steel Institute, with their German and American friends, met in international convention at Pittsburgh, on the 9th, where, after the usual speeches of welcome and replies thereto, which were all, of course, felicitous and full of expressions of good will and friendship, the reading of papers was commenced, Sir Lowthian Bell leading off with a paper on "The Probable Future of the Manufacture of Iron." Sir Lowthian Bell is generally recognized as one of the greatest, if not the greatest living authority upon iron and steel manufacture, and his paper is for that reason especially interesting, and we only wish that space permitted its publication in full. In introducing the subject he said:

With the exception of air and water, it is open to question whether there is any form of matter which the human race could less easily spare than iron. Short of going the length of asserting that, without this metal for an anchor or steel for the compass, the adventurous navigator could never have crossed the wide Atlantic, we may credit the locomotive and the steamer, and hence iron, for that sequence of events which has peopled North America with the Anglo-Saxon race. The result has been to raise a vast territory to a position without a parallel in the progress of the world. To the attractions afforded by this interesting episode in modern history may be added the unprecedented development, in the United States, of that branch of industry which most concerns this society. Let me remind you, although we are guests upon the present occasion, and Great Britain is the birthplace and home of the Iron and Steel Institute, its name and constitution were intentionally adopted so as to exclude geographical boundaries from being any limit to the scope of its operations. Accordingly, these cosmopolitan intentions have been followed by our numbering in our ranks considerably above 200 members belonging to other countries, and of these nearly one-half are inhabitants of the United States. This union between members of one great family is a subject of sincere congratulation to the founders of the body, and, I feel sure, is not without interest to those who have joined it from the Continent of Europe.

The present assembly is, so far as my reading goes, without a precedent in the annals of industry. Manufacturers of a metal from the Old World, where, in spite of what has been said by some antiquarians to the contrary, iron probably has been made for thousands of years, have accepted a courteous invitation from those of the New, with a view to discuss questions of interest common to both. To carry out this intention, three representatives from each hemisphere have been deputed to prepare subjects for this international congress, and I shall always consider my having been chosen by the Council of the Institute to act on their behalf, as a very high and flattering distinction. The heading of this paper implies that I propose addressing myself to the future rather than to the past; but as any estimate of the probability of what is going to happen must be founded to a great extent on what has already taken place, some reference to the ancient history of the iron trade would seem not altogether superfluous.

As is well known, man, in the earliest days of his existence, is supposed to have supplied his wants, first with implements of stone, and then of bronze. This conclusion had been arrived at by the discovery of articles suitable for the chase, for war and other purposes, made of one or other of these two substances, whereas iron was never met with, and hence prehistoric man was regarded as having known little or nothing of the existence of this metal. More recent explorations, however, have proved that instruments of iron, when protected from atmospheric influence, have frequently been discovered in different parts of the world. If, then, as is quite possible, implements made of stone or of bronze were in use long before those of iron, it is perhaps equally certain that the latter metal was in more common use at a very remote period than was at one time believed. Apart from these discoveries, let us consider the question of a knowledge by the ancients of the existence of iron as one of mere probability. The ores of this metal are by far the most abundant of all metalliferous minerals, and they are met with in almost every geological age. In the lowest type of savage life it could scarcely have escaped notice that a morsel of this abundant ore, surrounded by glowing charcoal, produced a metallic mass capable of being forged into objects greatly prized in daily life. Captain, now Colonel, Grant, the companion of Speke, found the isolated barbarians near the great African lakes familiar with this mode of obtaining iron, and he made a sketch for me, showing a couple of men engaged in this occupation. The means employed was simply a Catalan fire of a less rude character than others which have been described by different authors. Some of these depended on the wind for their blast, whereas each man in my drawing is seen manipulating a couple of single-action bellows. As regards steel, we know that in comparatively remote antiquity the low Catalan fire had its dimensions so increased that white cast-iron could not have failed to have been formed, and with this at hand the power of producing the less carburized form of the metal could scarcely have long remained a secret.

So much for speculation; but we have more recently obtained proofs that the ancients appear to have had far more knowledge of the metallurgy of iron than that for which they have received credit. How else can we account for the forging of a column of the welded metal nearly twenty-five feet high, and weighing some six tons? It is of great but unknown antiquity, and was found standing upright at Delhi, where it still remains. Heavy masses of iron have also been discovered for supporting the masonry in doorways and other openings in ancient buildings; and although the blast furnace appears not to have been known when Agricola wrote his De Re Metallica, dated 1556, evidence is not wanting that carburized or cast-iron has been found dating from a much earlier period. These admissions, of course, do not necessarily imply any knowledge of the property of iron to unite with carbon and form a body capable of cutting iron itself, and of chiseling the hardest rock. The absence of this equally corrodible compound from the monuments of antiquity is, however, less difficult to account for than that of any other metallic bodies, all of which are less liable to perish from the action of the atmosphere than steel.

Coming down to a more enlightened period, the precise date of the invention of the blast furnace, the haut-fourneau of the French, and hoh-ofen of the Germans, is still not known, but it is supposed to have been introduced at the latter part of the sixteenth century. The first change effected by the discovery was the gradual and almost complete banishment of the Catalan ore process, but while pig-iron became the source of malleable iron, the Catalan, or a similar form of furnace, was retained for the purpose of conversion, and it remained in use for 200 years or more. Its place was gradually taken by the puddling furnace of Cort, which, and with the exception of the small quantities of expensive bar iron made in Russia and Sweden, almost all the metal produced in the malleable form was obtained by means of this furnace, since its invention in 1784 down to the year 1860.

After speaking at some length of the different processes used, he concluded as follows:

It is against the appliances which have enabled us to perform what may be regarded as a marvel of economy—against the blast furnace making 1,000 and even up to 2,000 tons in a week, and one or two Bessemer converters, as the case may be, turning the whole into steel as the metal runs from the furnace, that a process, which has practically made not one step in advance during the last fifty years, ventures in our day to wage war.

If there is a spark of vitality in this obsolete plan, what have our iron masters been about, that they have not blown it into life? We have had, and have now, men among them who have distinguished themselves by the manner in which they have taken hold of every sound idea, scientifically propounded or otherwise, and insured its success, often beyond the most sanguine expectations of the most sanguine inventor. It may well be asked how it is that this direct process has, up to this time, ended in direct failure. Perhaps some one else will endeavor to answer the question, for as regards myself, my fears as to its merits were published sixteen

years ago. All that I can add to what was then said is that its future chance of success must depend on counteracting the obstacles referred to in this paper—obstacles which hitherto have constituted a barrier between every direct process and commercial success.

It has also been proposed to accelerate the direct process, and for that matter a great many other things, by the use of water gas, a form of combustible of which a good deal has been said of late. It is not to be denied that hydrogen gas, forming, as it does, half the volume of water gas, the other half being carbon already partially burnt, may, as a combustible, have an assured value in certain special cases. The hydrogen element affords above four times as much heat as the same weight of carbon, but unfortunately, and unavoidably, it requires more than four times as much carbon to produce it. We might, therefore, as reasonably expect a hydraulic wheel to pump back all the water which had served to move it as to hope to be able economically to burn any combustible twice over; for that is the impossible problem the water gas makers ask us to accept as possible. It is almost superfluous to say that the same line of argument is more than equally applicable to a proposal to use water gas in the blast furnace, which was also mooted some ten years ago. Its utter unfitness for this office is apparent when we consider that any steam formed by the combustion of hydrogen, and any carbonic acid generated by burning carbonic oxide at the tuyeres, will be returned to their original condition of water gas the next instant after their formation. In other words, heat generated by their being burnt will be entirely absorbed by the return of the constituents to the form in which they existed in the water gas previous to its combustion.*

In face of the admitted advantages in quality and cost of conversion of ingot over puddled iron, the fact that 2,250,000 tons of ordinary malleable iron were made in 1889 in Great Britain may seem, and no doubt is difficult of complete explanation. There are several circumstances which conduce to this continued vitality, but into these there is not time here to enter. Possibly the puddling furnace may be employed for many years to come, but everything seems to point to a gradually decreasing demand for its produce. Should the day ever arrive when the labors of Bessemer or Martin's adaptation of the Siemens furnace for decarburizing pig-iron entirely supersede the process of puddling, it must not be forgotten that the world owes to Cort an invention which, of itself, had revolutionized the art of locomotion, by sea as well as by land.

Mention has been made on a previous page of the hurtful effects of phosphorus in pig-iron for steel making purposes. Unfortunately for Great Britain, its more extensive beds of ore were deposited at a geological period when the prevalence of animal life served to concentrate in particular localities the element so much objected to by iron manufacturers This source of contamination, as it was deemed, appears to have been in active operation during the carboniferous age, and still more so while the rocks of the lias and oolite were in course of formation. Thus it is that the ores known under the general appellation of clay ironstone give an iron containing from .05 to 2.5 per cent. of phosphorus, derived from phosphates, chiefly of lime, a common constituent in animal bodies. More than twenty years ago it was pointed out how beneficial it would be if this phosphorus could be eliminated from the iron and laid on our land. We have lived to see this accomplished by the basic process, and, having regard to the growing demand for steel, it is difficult to overrate the importance of extending the area we have to look to for the raw material. Mr. Gilchrist informs me that the quantity of pig-iron treated in the Bessemer converter and open hearth furnace during the year 1889 was close on 500,000 tons in the United Kingdom, and 1,174,000 tons in other parts of the world.

The effects of the presence of foreign substances on the properties of malleable iron and steel are now universally recognized. This observation is more particularly directed to the injurious consequences which often result from the silicon, sulphur and phosphorus which remain after the conversion of the pig-iron into these two forms of the metal. On the other hand, the service rendered by carbon, in conferring increased strength and elasticity on iron, cannot be exaggerated. This fact has naturally led to the inquiry whether other elementary bodies may not assist either in carrying off hurtful matter or in increasing the valuable properties just referred to.

The discussion on the paper was opened by Mr. George W. Maynard, who confined his remarks chiefly to the description of a direct process plant now in operation in Pittsburgh, giving results obtained from it which made a very favorable showing.

* It is a remarkable fact that the document recommending this application of water gas was accompanied by a statement of an actual trial made at a Belgian iron works, every line of which proved, in unmistakable terms, its complete failure.

He was followed by Prof. H. M. Howe, of Boston, and G. J. Snelus, of Workington, England, who described experiments made by him over twenty years ago with the direct process.

In closing the debate Sir Lowthian Bell said:

I do not know that I need detain the meeting very long to make reply. I will just add that so far as the operation referred to by Mr. Snelus is concerned I have myself had some correspondence with Mr. Blair. In the year 1874 I visited Pittsburgh, and was taken by Mr. Blair and most kindly received by himself and his partner—Mr. Morrison, I think—to their works in the immediate vicinity of this city. The figures illustrating their process were submitted to me in the most open manner. I endeavored to the best of my ability to show to Mr. Blair by his own figures that nothing but failure would ultimately attend the process. I am sorry to disagree in that, but I need not remind the inhabitants of Pittsburgh what the fate of the works was which undertook to make iron by the direct process of Mr. Blair. Now, leaving altogether the question of economy out of consideration—which, of course, one cannot do—but looking at it as purely a matter of chemical reaction, no process that I know of could be more perfect in its character than that adopted by Mr. Blair. It was the Chenot process, with a little refinement, and so arranged that a saving of fuel, at all events in heating the ore, was attained. All oxidation from the atmosphere, so far as was possible, was avoided by the sponge, as it was drawn downward and received into air-tight cases until it was cooled, and the sponge was then mixed with coal tar, and under very powerful hydraulic pressure was pressed into bricks or cylinders, and these were then transferred to an open hearth furnace, in which there was a certain quantity of pig-iron in order to produce steel. It was there that I pointed out to Mr. Blair at the time that the great loss occurred.

My friend, Mr. Maynard, has not told us anything about the loss that is incurred in treating the blooms obtained by this new development of the direct process. That is a most important matter. Now, with regard to the total fuel required. Pray remember that this ground coke which is used in the reducing furnace amounts to 960 pounds to the gross ton of iron. In other words, they are using in this furnace more than one-half the coke which is used in the blast furnaces. That is, instead of using about 1,808 pounds, they are using, as we learned the other day at the Edgar Thomson Works, 960 pounds; that is, instead of saving about 400 weight of coal, as is done in the Bessemer furnace, they use nearly one ton of coal for the reduction of the ore. That is, you have to use 960 pounds of coke which has to deoxydize the air, and then you have something like a ton of coal to use in order to heat the blooms before you are ready to heat the ore for its reduction. Now, independently of all that, I am surprised that gentlemen should talk in the very easy and airy way in which they do, of grinding the quantity of ore that you have to deal with in order to bring this industry into anything like an industry of importance. We are told that we must grind the ore into the finest possible divisions, and they speak of it as if that was a thing of easy achievement. Conceive that you are to start and grind the whole of the ore in the Lake Superior region, which I think is something like 17,000,000 tons per year, into a fine dust, and you have an idea of what you are proposing. I admit that there may be some cases in which very fine ores might possibly, to a very limited extent, be so treated, but to expect to raise that to a great industry, and to compare that with what has been done in the blast furnace, is, in my opinion, one of the most Utopian ideas that ever entered the mind of man.

Mr. Snelus in like manner seemed to underrate the obstacles in the way of obtaining that result. At all events, the gentlemen whom he mentioned certainly did not in their experience attain it, and certainly they were characterized by a patience which you rarely find in a manufacturer. They continued the work until it was impossible to continue the operation any longer, and it disappeared like many other of the direct processes before it. I do not know that I can add anything more to what has been already said. I cannot say that the observations of Mr. Snelus or Mr. Maynard have made a very profound impression upon my mind.

This was followed by Sir Nathaniel Barnaby on the Protection of Steel and Iron Ships against Foundering, and this by Mr. A. E. Seaton's paper on the "Development of the Marine Engine and the Progress made in Marine Engineering during the last Fifteen Years," from which we quote as follows:

In this paper it will be my endavor to trace the development of the marine engine and its appurtenances, and the general progress that has taken place in marine engineering generally during the past fifteen years, rather with the object of attributing much of it to the successful efforts of the members of this Institute in their various capacities, and thereby to render my thanks to them for the very valuable service they have contributed to my profession, than to tell of what has been achieved by the skill, ability and perseverance of my colleagues in shipbuilding and engineering. The engineer has been at all times dependent upon the ironmaster, and on more than one occasion his progress has been barred by the inability of the latter to overcome some obstacle to success in his manufacture; but, on the other hand, it is equally true that the ironmaster has often been ahead of the engineer, and has been prepared long beforehand to supply that which would make a success for the marine engineer if he would avail himself of it. That eminent engineer and most fruitful of inventive geniuses, Trevithick, who a century ago saw instinctively what was possible with steam of high pressure, had to resort to sorry contrivances to try his experiments with the force he knew would be so useful. His boilers, made of copper tubes in granite tube-plates, now might serve as a monument to his genius, and as an example of the straits to which he was by the circumstances of his time reduced, rather than as a proof of his ingenuity. It is true that since his day the tube or tubulous boiler has been employed successfully to generate steam of high pressure, and that therefore the boiler in question might be taken as another example of his prescience. It is nevertheless a fact that he did not succeed until the ironmaster of his day gave him iron plates, or, as we should be disposed to call them now, very broad bars. The dilemma that arose as to the shaft of the Great Western was removed by the genius of Nasmyth, an engineer; but the steam-hammer without the men to work a forge would have been a useless tool, and the cast-iron shaft would have had to take its chance; so that I infer that as much skill and invention were shown by those men who had to manipulate the iron with that hammer for the first time, as was required to conceive, design and make the hammer itself. History has not, therefore, been quite fair; for, although she has recorded the one feat, and has justly recorded her tribute of praise to the inventor of the tool, so far as I am aware there is neither name nor praise recorded of the men who worked it, nor of the ironmaster who erected it. I do not mean to say that the circumstances are not known, but there are now very few men who could give the information, and although only a comparatively short time has elapsed, their names are practically forgotten.

* * * * * *

The period chosen for consideration in this paper is one that embraces the genesis of the modern development of the marine engine and boiler; but it is, moreover, the time that has elapsed since the introduction of Siemens steel, to which I attribute much of the progress that has recently been made. Prior to that time iron was used almost exclusively in the construction of marine boilers, and very little steel indeed had been used in the engine. Boiler shells were made of Staffordshire iron plates, or of such other iron as was equal to it in both quality and price; the insides, such as the furnaces and fire-boxes, were made wholly or nearly so of what was familiarly known as "Lowmoor quality." The price of the latter was very high compared to that of the steel we now use, and may be taken as £30 per ton on the average. The Staffordshire iron would at that time average about £9 for a boiler made of comparatively small plates, and £12 for a boiler made by a more enterprising engineer with larger plates. There was practically no limit to the boiler pressure, so far as the internal parts were concerned, but the working pressure was decidedly limited, in so far as it was governed by the shell. There were then some few firms that could supply a plate one and one-eighth inch thick of fairly large dimensions, and in some very few instances plates as thick as one and one-quarter inch were used. Taking the former as the most common and also the most convenient thickness, it meant that a boiler fifteen feet diameter would pass only for a working pressure of seventy-five pounds, or if 100 pounds pressure was required, the limit to diameter was eleven feet three inches for single-ended boilers, and something less for double-ended ones. For a pressure of 150 pounds the diameter would have been only seven feet six inches. Now, it need not be urged that this was prohibitive of higher pressures, although it had such an effect indirectly, inasmuch as the stays, etc., being of iron, too, would have been either of monstrous size or so close together as to render the construction impracticable. The weight of such boilers was also very much against them, and altogether it required more courage than then existed, and certainly less caution than then obtained, to attempt such strides as have been since successfully accomplished. I have stated that there was no theoretical difficulty with the insides of the boilers, but, as a matter of fact, there were some practical difficulties to encounter. Lowmoor iron was especially liable to blister from innumerable laminations when exposed to heat, and these blisters caused trouble enough with the pressures and temperatures then ruling. What the troubles might have been with the thicker plates, higher pressures, and higher temperatures were not known, and, like all unknown terrors, were feared most. There were also means well known for stiffening the furnace so as to withstand higher pressures; but these very means were also often sources of mischief, and always feared, as likely to lead to accidents. It is true that we had the locomotive boiler working at pressures far beyond that of the ordinary marine boiler, but marine engineers were very chary of trusting to it, and events proved that their suspicions were not without foundation; for even now that the locomotive boiler has been used on shipboard to a considerable extent, its success on the sea has been decidedly qualified, and no one will use it unless circumstances compel him, and then only when he can get a supply of fresh water.

* * * * * *

A steamer for passenger service only could have been built for the speeds now attained at far less cost in every sense of the word. It is only those who have to work out some of the problems set them by shipowners that appear to know and to appreciate the tremendous cost that is paid for the ability to carry the few hundreds of tons of cargo possessed by the "Atlantic greyhounds."

In 1875 there were many ships in the British navy capable of doing fifteen knots per hour on trial trips, but very few that could maintain that speed at sea. The necessity of having ships that could maintain that speed existed as soon as the mercantile ships of Great Britain could accomplish it; for not only would it be required that in time of war such ships should not be convoyed, but the possibility of an enemy possessing such ships with which to harass the trade of the country was apparent. There was also the necessity of unarmored cruisers to possess a superior speed to battle ships for obvious reasons, and to act efficiently as sea police they must have a speed superior to that of any ordinary ship afloat. Hence the demand for better speed in her majesty's navy. The competition among the various steamship companies running in connection with railway routes, and others in competition with railway routes, caused a demand for an increase of speed for a different class of ships. In fact, in every direction there existed a demand for more speed, so that there was every incentive to the shipbuilder and engineer to exercise his keenest wit in devising new ways of accomplishing this desirable end. It will now be my task to show how this has been accomplished by the marine engineer, so that the public can now travel at higher speed, with greater safety, with increased comfort, and at no higher cost than obtained on the ocean fifteen years ago.

I have stated that one way of obtaining speed was by making ships with finer lines, and this had always to be done at a considerable sacrifice of carrying power. Steel has, however, to a large extent obviated the necessity of such a sacrifice. New methods of construction and new forms of material have also tended to this end. Ironmasters now supply at reasonable rates bars of Z section, whereby the framework of the ship is much lighter, and at the same time stronger, than the old combination of angle bars. Then, too, this splendid steel that you now give us is capable of being so flanged, and that, too, when cold, that there no longer exists the necessity of riveting to the plate an angle bar, if it is sought to stiffen it, or to connect it to other work. You supply us now with such materials at practically no extra cost, that we can construct our ships with much fewer plates, whereby we avoid the cost, weight, and disadvantage of so many joints. You are no doubt told from time to time that this new material has a serious fault—that with all its good qualities it is not so durable as the older one. This has a sufficient foundation of truth to make the opposition to it powerful; but with very ordinary precaution and care, experience has shown that it can have the same endurance; and there is no doubt that, with a better knowledge of how to treat it, this objection will entirely disappear, just as the same objection to iron ships existed, and has now been almost forgotten. The best remedy is to get rid of the mill scale before painting. But while admitting that the naval architect has done much to bring about a successful solution of the speed problem, I must maintain that the marine engineer has done more. His path was not so obvious nor so clear before him, and new openings have often shown themselves in unexpected places. Whether the marine engineer starts with a fixed weight given him by the naval architect, or whether the latter accepts such from the former, and designs the ship accordingly, is immaterial. The fact remains that the engineer, in order to get the maximum power, must get each individual horse-power with the minimum of weight, in order that the ship may be a success; and his problem has been how to do this without adopting too costly processes.

[Further extracts from this paper will appear next week.

Opening of the Colleges of Mechanical and Electrical Engineering—Cornell University.

Frank C. Perkins, of Ithaca, N. Y., writes us as follows about matters at Cornell University:

The outlook for the engineering departments for the coming year is surely a most pleasing one. The entering class exceeds that of any previous year by ten per cent. The total number of students in these departments nearly reaches five hundred. The inadequate capacity of the shops for accommodating the large and steadily increasing number of students has finally led to a complete reorganization of that department, and the construction of new workshops.

The new machine and wood-working shops now each occupy a room 50x180 feet, the wood shop being directly over the machine shop.

Separated from the machine shop by a glass partition is the new engine testing laboratory and the electric lighting station of the university. Here are placed six modern high-speed engines having a combined horse-power of 250. Westinghouse and Edison dynamos supply the incandescent light for the buildings, while the campus is lighted by Thomson-Houston, United States and Westinghouse alternating arc machines.

The blacksmith shop and foundry occupy a separate building 50x150 feet. In the former shop are set up 24 Buffalo forges and a Bradley cushioned hammer, while the latter affords floor space for working 30 men at a time, or about 100 per day.

The new dynamo-room of the electrical engineering department adjoins the workshops. Here are set up between thirty and forty dynamos and motors of various kinds. These are used entirely for experimental purposes. Power for running the same is furnished by a 75 horse-power turbine, a 30 horse-power straight line, and a 40 horse-power Ide engine.

The chemical department has been removed to its new building, a large brick structure 60x200 feet, four stories high, and fitted with laboratory and lecture-room accommodations for one thousand students. This leaves Franklin Hall entirely to the physicists and electrical engineers, largely increasing the facilities of these departments.

The mechanical laboratories have been considerably enlarged, and are now in charge of Prof. Carpenter, formerly professor of mechanical engineering at the University of Michigan.

The blast from a large Buffalo blower has been introduced into the boiler-room for increasing the draught, and consequently the capacity of the boilers. The capacity of the set of boilers is now about 400 horse-power, and it is proposed by this system of forced draught to considerably increase it. These boilers furnish steam for heating the buildings and for the engines.

Machinists' Supplies and Iron.

New York, October 18, 1890.

Iron—American Pig—Standard brands continue to be pretty closely absorbed, though some of the less known brands are at times freely offered. No new developments have appeared during the week, the general condition of the market continuing about the same.

We quote No. 1 Foundry, standard Northern brands, $17 to $18; No. 2, $16 to $16.50; Southern brands No. 1 Foundry, $16 to $17; No. 2, $15.75 to $16.

Scotch Pig—Labor troubles, which are still unsettled, are still affecting the prime markets, production being curtailed, and prices firmly held, though no rise has taken place. The demand here has, as usual, been very light.

We quote Coltness, $25.50; Dalmellington, $22; Eglinton, $20.50.

Bar Iron—The improvement noted last week in the demand has, so far, proved permanent, but prices are not quotably changed.

We quote Common, $1.85; Medium, $1.90; Refined, $1.95 to $2.00 for round lots on dock.

Plates—The supply seems more abundant than formerly, and prices have been shaded somewhat, though quotations remain the same.

We quote Common Tank, $2.25 to $2.30; Refined, $2.35 to $2.45; Shell, $2.35 to $2.45; Flange, $3.40 to $3.45; Extra Flange, $3.60 to $3.75.

Lead—The demand has fallen off somewhat, and concessions are made in buyers' favor in some cases. Car lots, for prompt delivery have been held at 6.10c. to 6¼c.

Spelter—The market has ruled quiet, but firm, the offerings being light. The product is, to a considerable extent, contracted for ahead.

We quote ordinary brands of Western at 5.90c. to 6.00c; choice, 6.00c. to 6.10c; refined, 6.75c. to 7c.; Silesian, 7⅜c. to 7½c.

Tin—There has been a sharp decline in London, and the market here has been more or less demoralized. Prices are at about 20c. to 21½c.

Antimony—The market has ruled quiet.

We quote Hallett's at 19c. to 19¼c.; L. X., 20¾c.; Cookson's, 21¼c. to 21½c.

Copper—The demand for Lake has been moderate, and the market is without notable new features. Lake is held at 17c.; common casting brands, 14¾c.; Arizona, 15¼c. to 15⅜c.

Lard Oil—The sales of all grades have been moderate, but prices for prime are maintained at 50½c. to 51c.

WANTED

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Mechanical draftsman, steady employment. Atlas Iron & Brass Works, Kaukauna, Wis.

Pattern maker, with A1 ref's, is open for engagement; steady, reliable. Pattern Maker, Am. Mach.

Wanted at Once—Six good general machinists; apply in person if possible. Taunton Locomotive Mfg. Co., Taunton, Mass.

Wanted—Three first-class erecting men who have had experience on high-speed automatic cut-off engines. Phœnix Iron Works Co., Meadville, Pa.

Wanted—Six practical experienced iron moulders. For further information address Haxtun Steam Heater Co., Kewanee, Ill.

Foreman wanted for machine shop, to handle about 75 machinists to advantage. Address B 2, American Machinist.

Wanted—Mechanical draftsman and designer, one familiar with steam engines of the single-valve automatic type with shaft governor. Only a live and exp'd man need apply. J. M., Am. Mach.

Wanted—Practical machinist, with some money, to take an interest in and charge of established paying shops. Address, with reference, L. M. Newbury, Sparta, Wis.

Wanted—Position as superintendent or assistant superintendent, by a man thoroughly exp'd on heavy marine and stationary engines, rolling-mill and blast furnace work, etc. Estimate, Am. Mach.

Machinists Wanted—First-class floor hands and fitters of large experience and of good habits can find steady employment and liberal wages. Address Morgan Engineering Company, Alliance, O.

A young man, thoroughly understanding the care of woodworking machinery, desires position to take charge of same where only good work is wanted; state wages. Ability, American Machinist.

Wanted—A prac. and exp'd man for foreman in a foundry working 10 or 12 molders; work, architectural work and gen. jobbing, connected with a gen. jobbing mach. shop. General Jobber, Am. Mach.

Wanted—Draftsman and designer; a first-class man acquainted with our class of work; also a second man as assistant, a technical graduate with two or three years' experience. Address Fitchburg Machine Works, Fitchburg, Mass.

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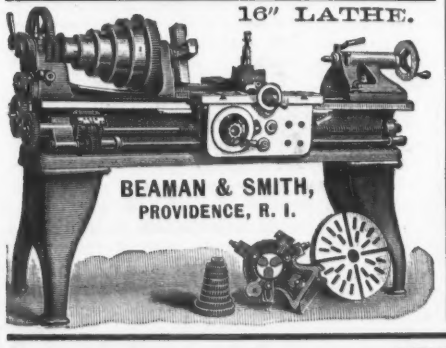

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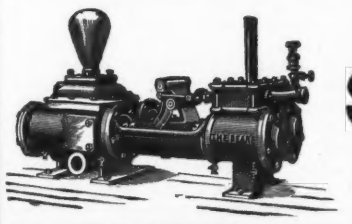

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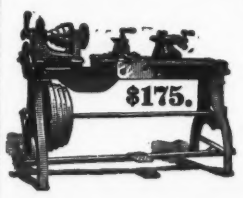

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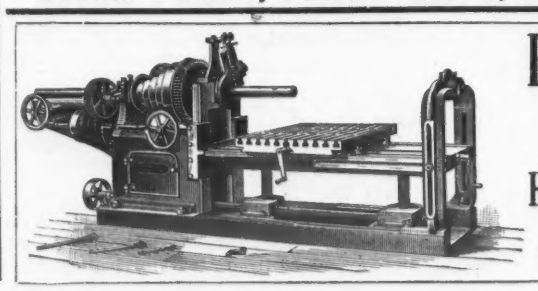

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Wanted—Medium-sized special machine or tool to manufacture under royalty, by machine works, Philadelphia. Address Box 88, AM. MACHINIST.

Well located foundry and general repair shops for sale cheap, owing to death of proprietor. Address Helen Woodworth, Admin., Nunda, N. Y.

For Sale—Old-established foundry and machine shop doing good paying business, booming town, East Tennessee, for $6,000. Address Box 93, AMERICAN MACHINIST.

For Sale—Bound volumes of the Patent Office Gazette for years 1883, 1884, 1885, 1886, 1887 and 1888. Price, $4 per year. Address J. C., care of AMERICAN MACHINIST.

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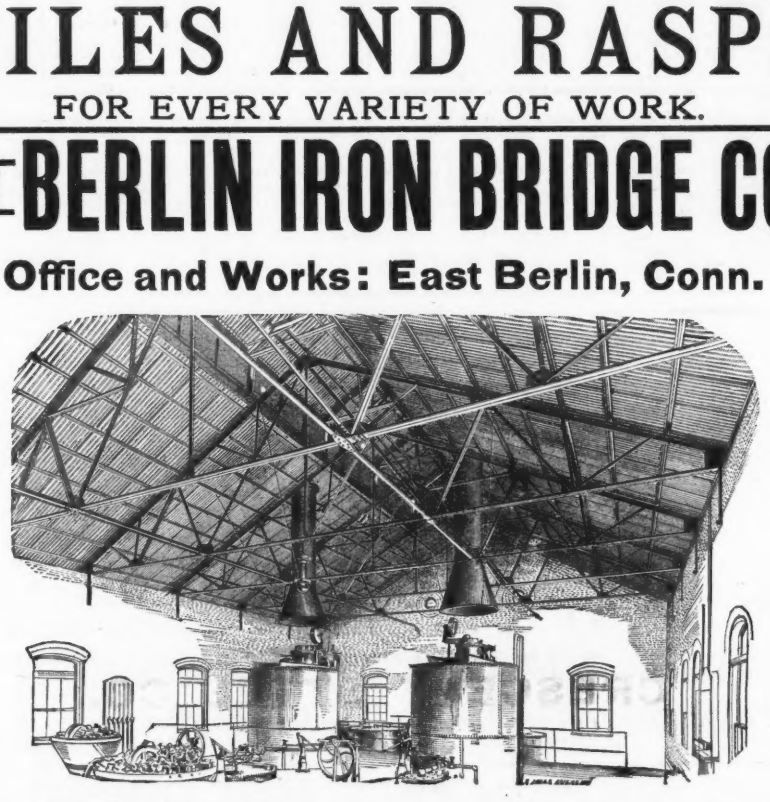

The above cut is taken direct from a photograph of an iron roof built by us for the Providence Gas Co., at Providence, R. I., and shows the iron trusses, iron purlins, corrugated iron covering, and also the ventilator on the ridge of the building. There is not a particle of wood work about this roof in any way, shape or manner to take fire, and therefore the building may be called absolutely fire-proof. This style of construction commends itself more especially to Gas Companies.

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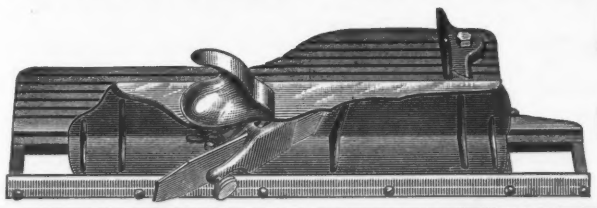

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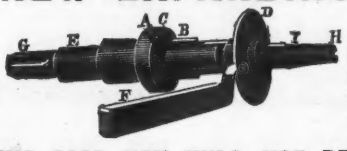

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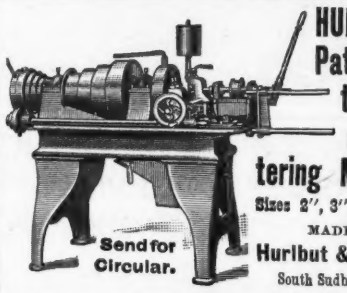

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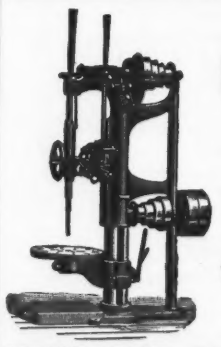

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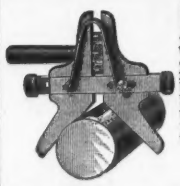

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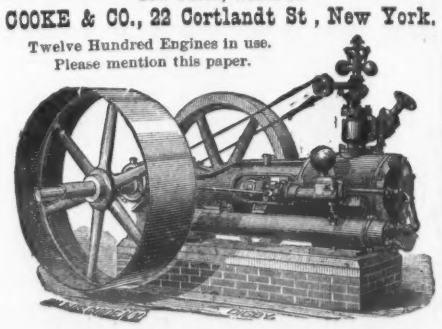

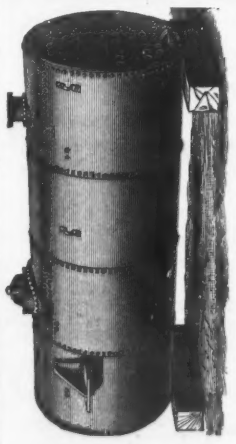

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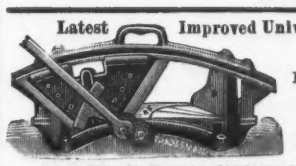

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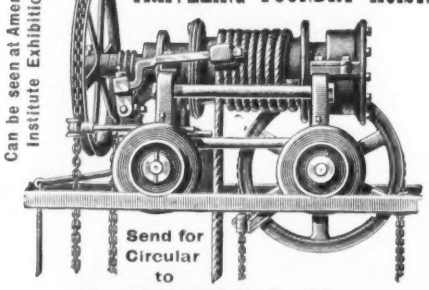

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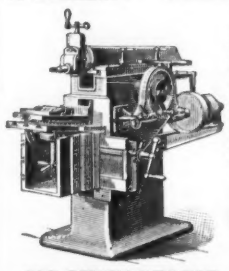

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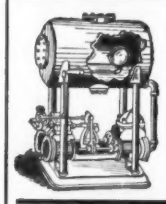

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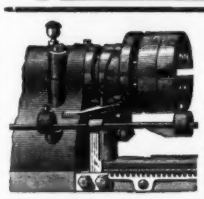

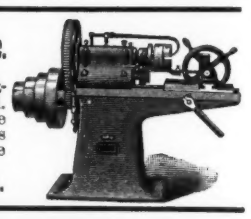

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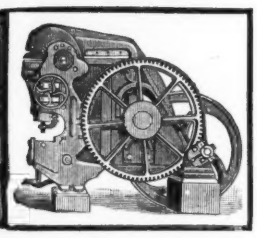

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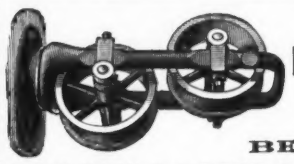

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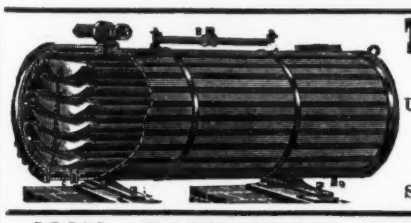

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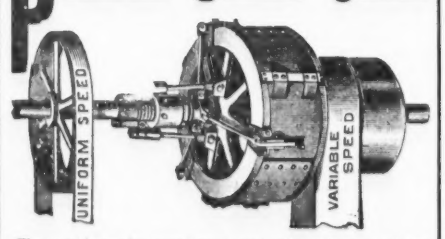

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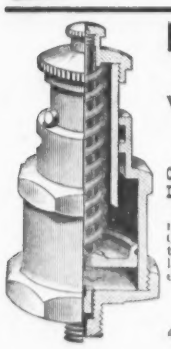

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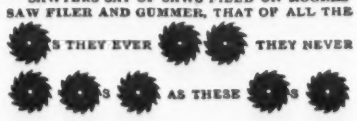

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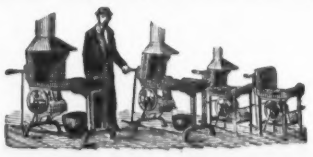

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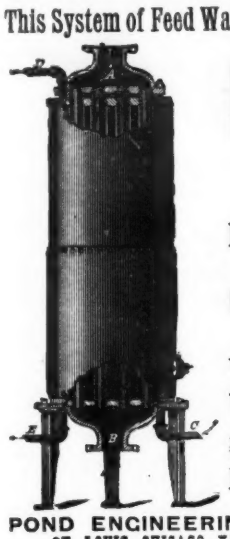

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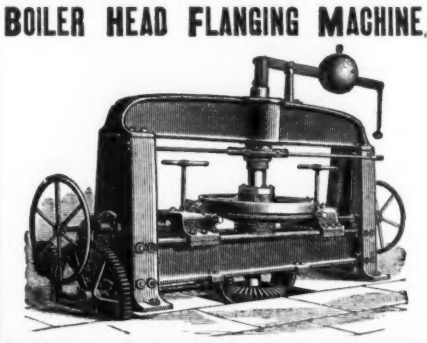

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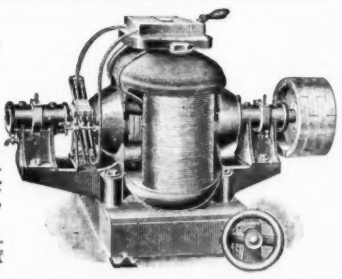

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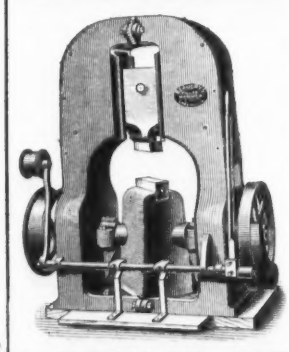

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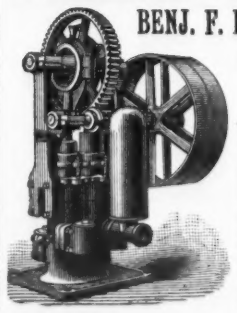

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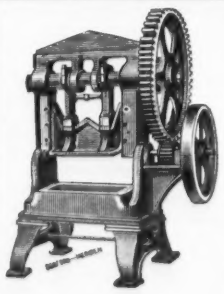

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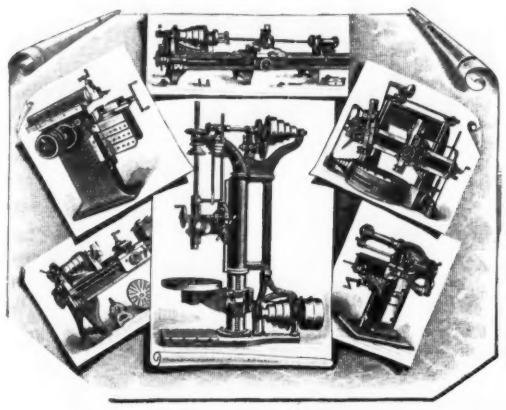

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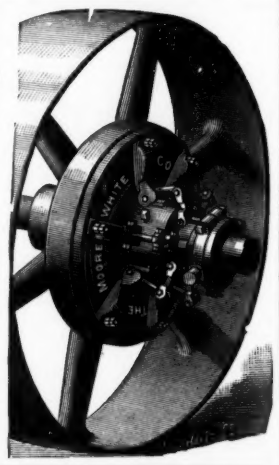

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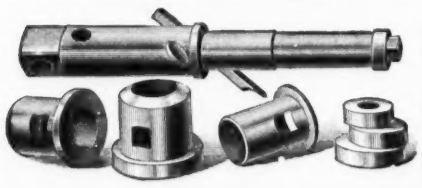

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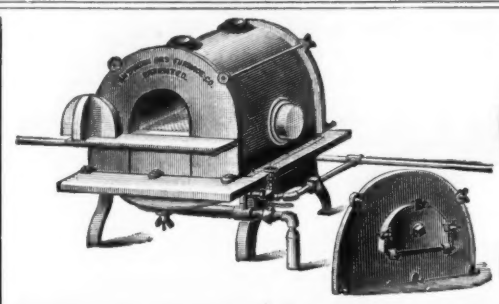

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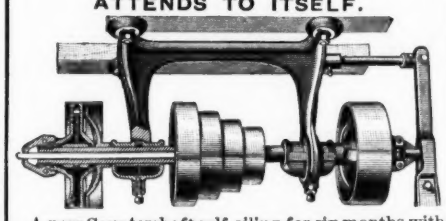

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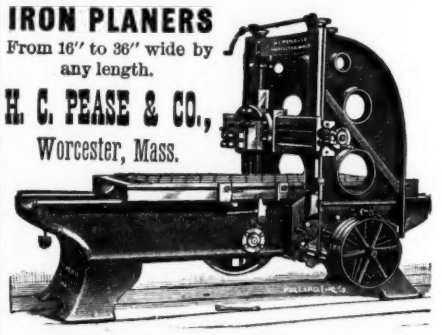

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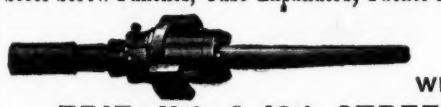

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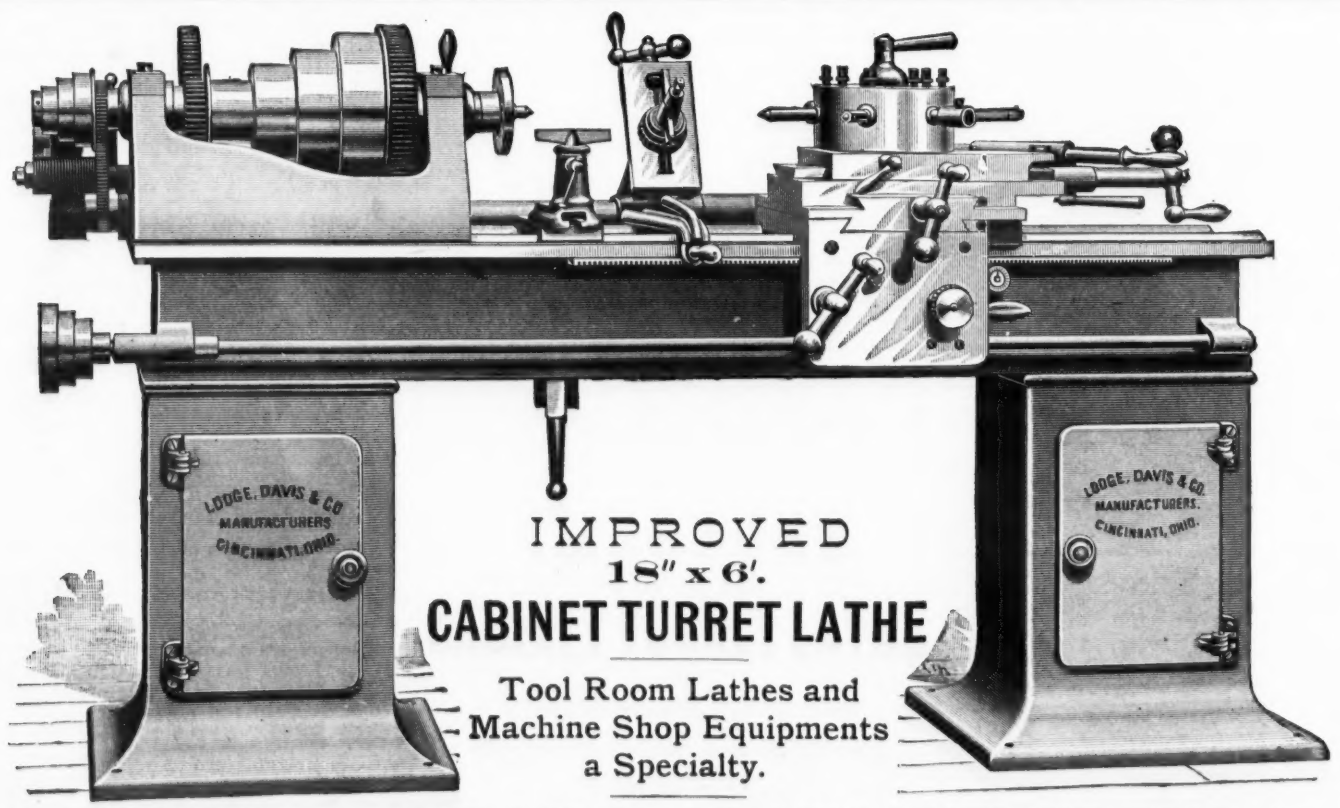

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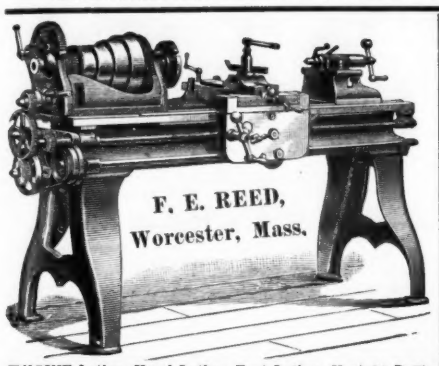

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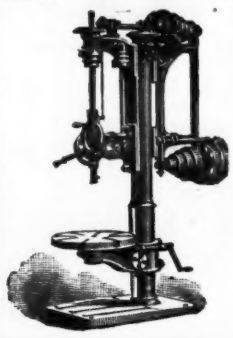

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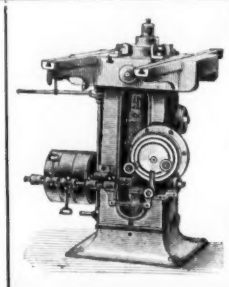

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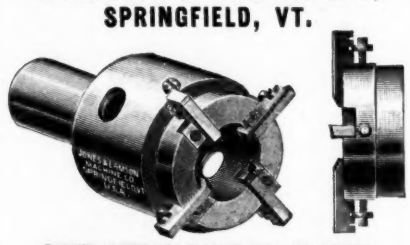

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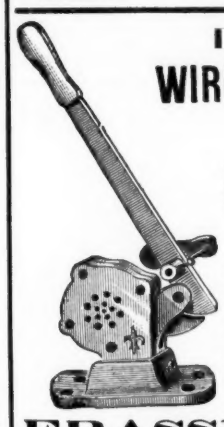

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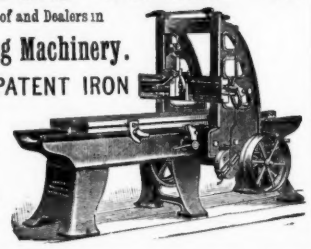

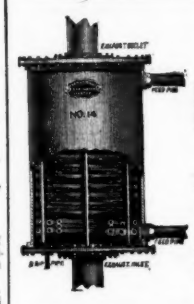

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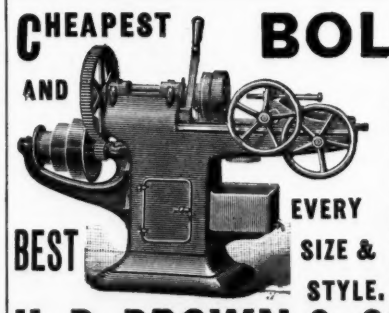

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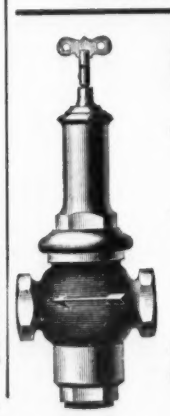

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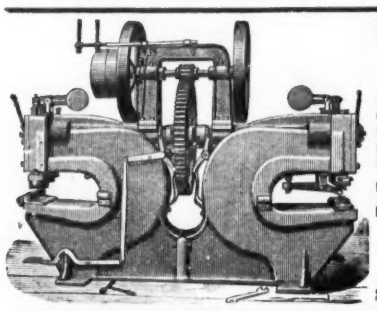

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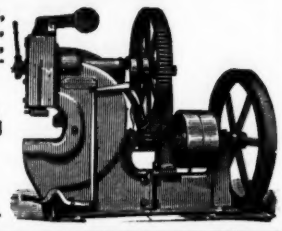

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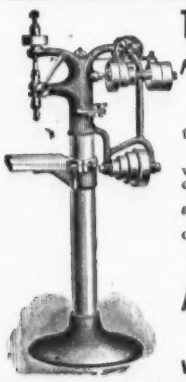

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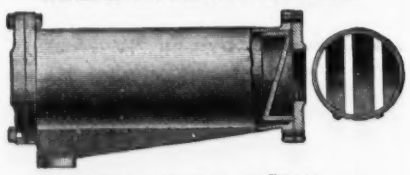

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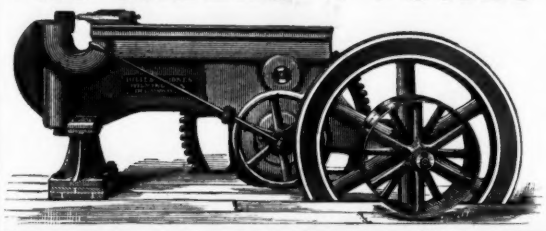

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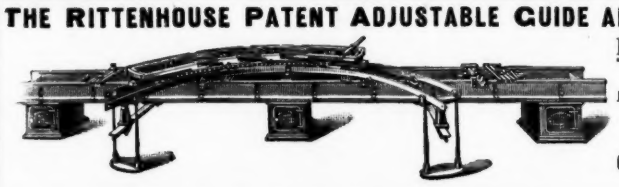

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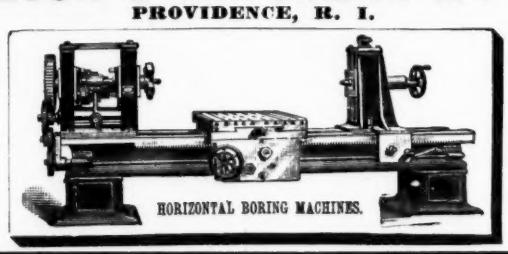

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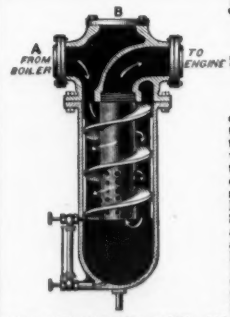

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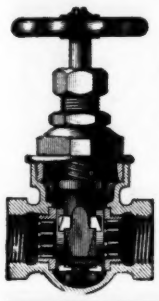

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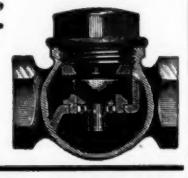

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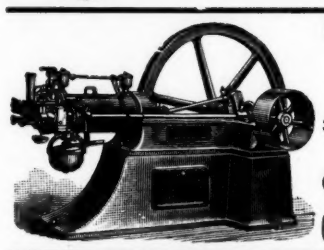

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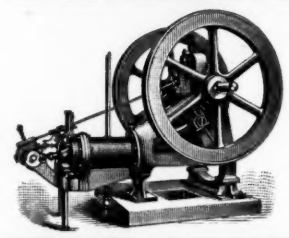

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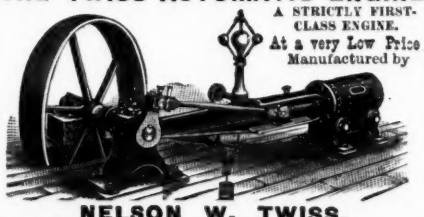

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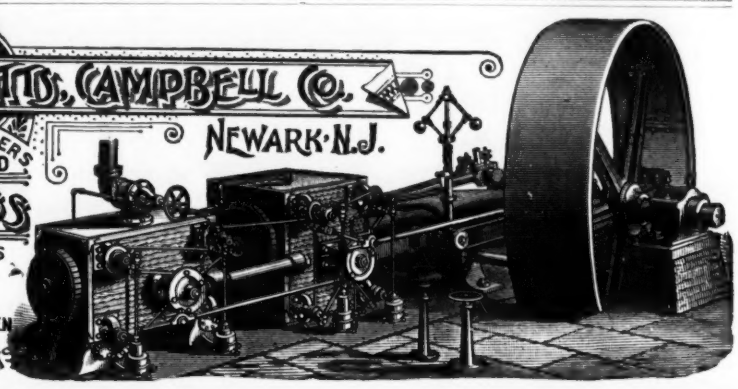

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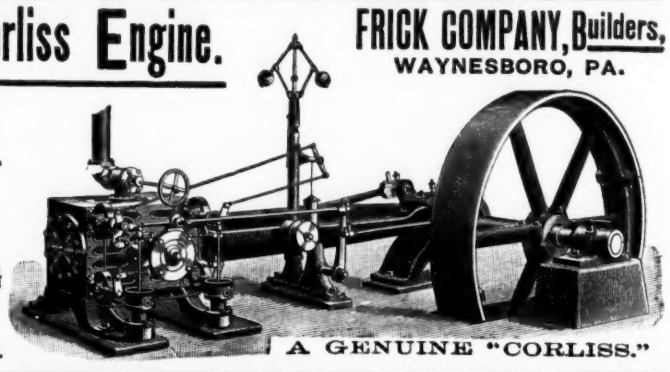

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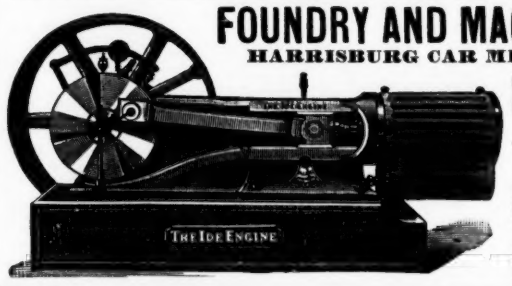

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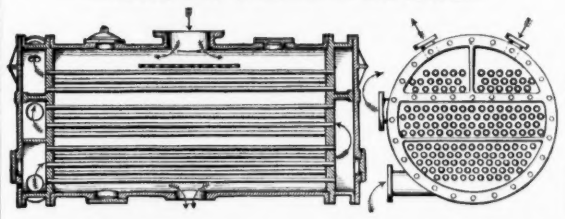

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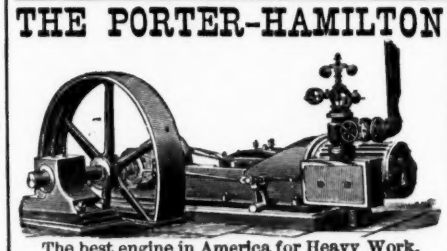

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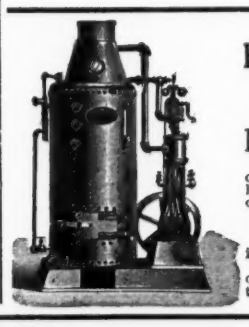

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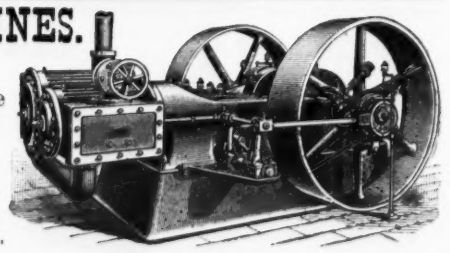

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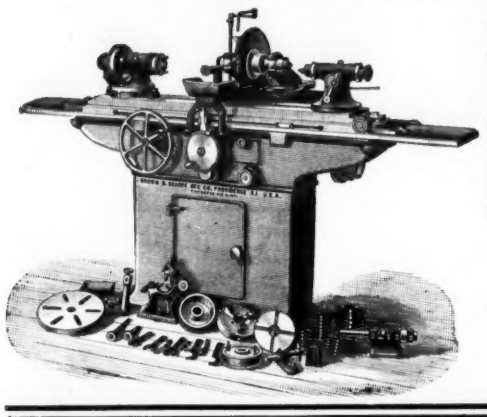
NO. 2 UNIVERSAL GRINDING MACHINE, IMPROVED.

Patented Feb. 27, 1877. Other Patents pending.



This machine is heavier, more rigid and of slightly greater capacity than the No. 2 Universal Grinding Machine. The bearing surfaces are larger, the reversing mechanism improved, and the cross-feed arranged for finer adjustments.

The machine is more powerful, and the overhead works provided for a wider range of speeds of wheel and work. It is specially adapted for circular grinding where accuracy and uniformity are required, and will grind straight or taper pieces, either inside or outside. Any angle, obtuse or acute, can be readily obtained.

Distance between centers, 30".
Weight, 4,000 lbs.

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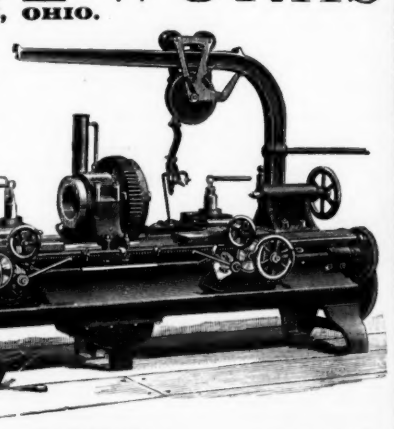

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15" & 20" Crank Shapers.
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20", 25", 28", 32" & 40" Standard Drills.
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12", 13", 15" & 18" Turret Lathes.
14" & 15' Fox Monitor Lathes.
12", 14" & 15" Hand Lathes.
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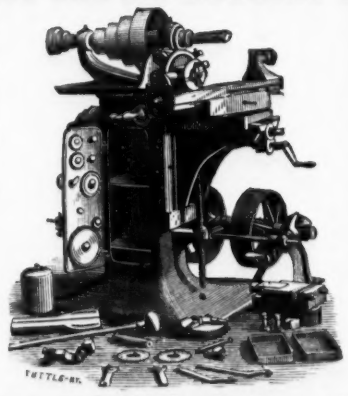

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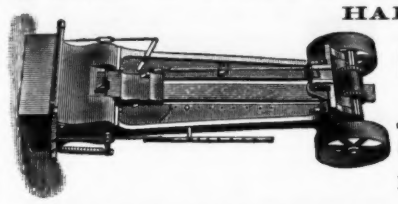

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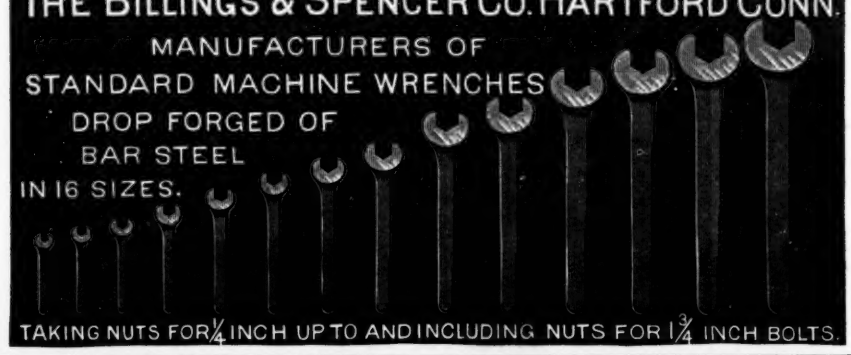

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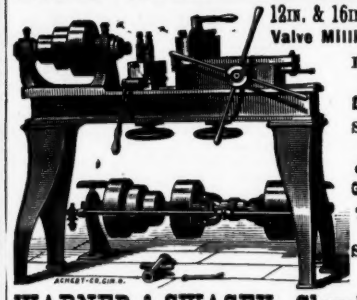

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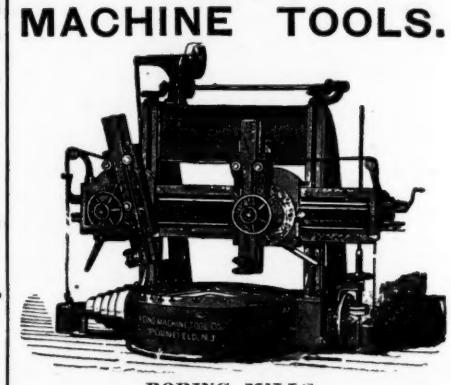

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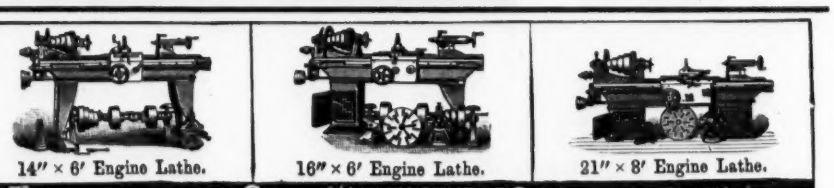

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